AL - BĪRŪNĪ

Commemorative Volume

Proceedings of the International Congress
held in Pakistan
on the occasion of
Millenary of
Abū Raihān Muhammad ibn Ahmad al-Bīrūnī
(973 – Ca 1051 A D)
November 26 1973 thru' December 12 1973

Editor

Hakim Mohammed Said

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Hamdard National Foundation, Pakistan.

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Commemorative Volume

International Congress, Pakistan

HAMDARD ACADEMY

HAMDARD NATIONAL FOUNDATION, PAKISTAN

KARACHI - 18

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which has admirably demonstrated its capability to encounter the growing world problems with discretion and selectivity wisdom and objectivity, maintaining itself within its organisational jurisdiction and still daring to step out where nobly desirable, to an extent that its name does not cover all it does

PREFACE

The creation of a new, independent state out of an ideological concept is usually attended by a host of besetting problems which proliferate with the race for progress around and the onslaught of scientific inventions and discoveries It is inevitable for such a young and independent state to pause a while at the cross-roads of decision to choose between the good and evil aspects of science

Pakistan is such a country It is a developing country and yet there can be no doubt also about its maturity which is endorsed by its ideological concept It is striving to hit upon a course between these two situations

It cannot afford to turn a blind eye on scientific and technological progress which Pakistan must not hesitate to employ as a tool for its growth, for grow it must to its full stature, with a determination to find a place of respect and distinction among the comity of nations

The convention of the al-Bīrūnī International Congress in Pakistan was in effect an endeavour in this direction The object of this Congress was not merely to rekindle a fresh interest in great men of science and letters in Central Asia and their achievements or to tie up some broken ends in the history of science, but to foster a tangible link of brotherhood in learning with great thinkers in the world of science

It is gratifying to realize that Hamdard National Foundation, in co-operation with UNESCO and the Pakistan Ministry of Education, was able to hold this International Congress on al-Bīrūnī, a subject which the world found worthy of attention and which later served as a milestone for holding an international conference on mathematical sciences

This book, which you have in your hand, contains the proceedings of the International Congress on al-Bīrūnī to publish which has been a singular honour for Hamdard National Foundation

I owe profound gratitude to my associates who gave me every possible assistance in compiling these proceedings as indeed they gave me every assistance during the Congress There has been some delay in the compilation and publication of these papers and proceedings, but their importance remains undiminished for scholars working in the field of science and history of science

Before compiling this book I had arranged the papers presented at the Congress according to the thesis and invited critical appraisals from

Mr A K Brohi and Dr Manzoor Ahmad for the section on Philosophy,

Dr Salimuzzaman Siddiqui, F R S and Dr Afzaal Hussain Qadri for the section on Science

Dr Mahmud Husain, Vice-Chancellor of the University of Karachi, and Dr Riazul Islam for the section on History

I am very sincerely grateful to them for their valuable cooperation. I am also deeply grieved at the untimely demise of Dr Afzaal Hussain Qadri and Dr Mahmud Husain

The completion of this book will not have been possible without the invaluable cooperation of Mrs Lily Anne D'Silva, who has been associated with Hamdard National Foundation for 22 years in the capacity of Executive, Culture and Arts Her massive work on this book has really been that of a co-editor, and her co-operation during the Congress is deserving of no less praise

I must also thank most sincerely all those scholars from different countries who accepted my invitation and whose learned papers contributed materially to make the Congress a success It is my pleasant duty to thank those scholars from within Pakistan who read papers and who welcomed delegates from abroad when they attended the sessions in Peshawar Islamabad and Lahore

The al-Bīrūnī International Congress was an excellent manifestation of the understanding which underlines the relationship between UNESCO and Hamdard National Foundation in the areas of education, culture and science I am highly indebted to UNESCO for their cooperation in giving this Congress the stature it deserved

The Pakistan Ministry of Education is known for its penchant for erudition The cooperation I received during the Congress from the then Secretary, Mr Q U Shahab, and from his associates, especially Dr S M Zaman (now Vice-Chancellor of Allama Iqbal Open University, Islamabad) deserves a special mention

It is a matter of great satisfaction for Hamdard National Foundation and myself, that this book is as long last going to scholars who value and love knowledge It is possible for me now to take in hand a revision of al-Bīrūnī's Book on Pharmacy and Materia Medica This book was published to mark the Congress in 1973 *on the spur of the moment I am keen to publish the second edition of this book now that I have received several opinions about it Another book— "Al-Bīrūnī—Life and Works"— is also ready for publication It is hoped that Hamdard National Foundation will publish it this year*

August, 1979

HAKIM MOHAMMED SAID

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FOREWORD

THE true measure of a man's greatness is shown by the degree of immortality that is granted to him by succeeding generations Judged by that yardstick Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī is assured of a high place among the immortals, even a thousand years after his birth The force of his personality which is glimpsed through his writings and his even more overwhelming achievements singled him out from among the various figures that dot the panorama of the history of science and civilisation, for commemorative celebrations in all the countries that lay claim to some part of his life or work Since a good part of his intellectual life was spent in the Sub-continent of Pakistan and India and where his major opuses had birth, Pakistan celebrated his Millenary in November-December 1973 with an International Congress

The celebration of the millenary is a part of the Project for the Study of the Civilization of the Peoples of Central Asia started by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1966 The purpose of the UNESCO Project is to make known better the civilization of the Peoples of Central Asia through studies of their archaeology, history, science and literature The Central Asian Region includes Pakistan, Afghanistan, Iran, Mongolia, northern part of India and several Asian Soviet Republics Pakistan has been assigned the topic of "History of the Development of Science" under the Project, established in the University of Islamabad The Hamdard National Foundation, Pakistan, dedicated to the task of research in the history and philosophy of science, has been doing whatever it can to highlight the achievements of the pathfinders The Millenary of Ibn al-Haitham, Father of Optics, celebrated in Pakistan in November 1969, was one link in the chain of this effort

AL-BĪRŪNĪ INTERNATIONAL CONGRESS IN PAKISTAN

SPONSORS

The Congress was jointly sponsored by the Ministry of Education, Government of Pakistan, and the UNESCO, and was hosted and organised in Pakistan, by the Hamdard National Foundation, Pakistan UNESCO's monetary assistance helped make the Congress international, inasmuch as it enabled the Foundation to ensure the participation of more international delegates by providing air transportation to them Thus the scope was widened and the achievements of the Congress, historical, literary etc , were of a far greater range than had it been merely national

" We have attended many Conferences and Congresses in different parts of the world, but the al-Bīrūnī International Congress in Pakistan has been a delightful and memorable experience This Congress was not one Congress but four Congresses merged into one Academically it has been an extraordinary success and we admire the thoroughly professional way in which the Congress was run Many lasting friendships were forged in the brief period we shared and this must be considered one of the great contributions of the Congress "

This was the consensus of opinion forwarded by the distinguished national and international delegates who participated in the Congress However, the entire responsibility of the Congress in its various phases, from planning the programme down to its successful implementation, lay with the Foundation The Hamdard had also the privilege of playing host to the delegates and financing the Congress in Pakistan

The al-Bīrūnī International Congress had a two-fold objective On the one hand, it sought to stimulate the world of scholarship in studying the works of al-Bīrūnī and his contemporaries The Congress was an enterprise in interpreting anew, in expatiating in modern terms, the wisdom or rather the experience of a great polymath whose contribution to the development of thought and knowledge has been significant On the other hand, it aimed at acquainting the Pakistani nation with its rich cultural heritage and to take pride in its remarkable traditions of which all the peoples of the world, knowingly or unconsciously, are the fortunate beneficiaries History is a continuous experience The history of a country or nation can be a cohesive entity, if there is a genuine linkage of the past with the present Backed by a united past and present, a nation can confidently march into the future Viewed in this light, the Congress was a successful attempt to bridge the generations' gap which occurred between scientific precepts of yesterdav and the precepts of today with their effects upon the continuity of both history and march of science

The Hamdard National Foundation, in all earnestness, accepted the responsibility of organising the al-Bīrūnī International Congress and, after painstaking effort, succeeded in gathering together scholars famous in the field of the history and philosophy of science, to represent the world of learning at the Congress At the same time, encouragement and impetus was given to national scholars to make their own distinctive contribution to the Congress The Foundation acquitted itself praiseworthily of the responsibility

PROGRAMME

The al-Bīrūnī International Congress had four sessions, one each at Karachi, Peshawar, Islamabad and Lahore In fact, the delegates termed it not as one Congress but as a series of Congresses, since each session was inaugurated

officially and held on a large scale The first inauguration took place at Karachi by H E Begum Ra'ana Liaquat Ali Khan, Governor of Sind, followed by the session at Peshawar, inaugurated by H E Mr Mohammad Aslam Khan Khattak, Governor of the North-West Frontier Province The Session at Islamabad was graciously inaugurated by the President of Pakistan, Mr Fazal Elahi Chaudhry, and at Lahore by the Governor of the Punjab Learned papers were presented by delegates, national as well as international, at all places The national press, radio and television gave ample coverage in their media and brought the proceedings of the Congress day to day into every home in the country The Pakistan Post Office issued special stamps of Rs 1 25 and 20 paisa denomination to commemorate the occasion

Seventy-five scholarly papers were presented at the Congress, some of them restatements of old themes in new forms, and many of them proving that the so-called "modern scientific theories" could indubitably be ascribed to al-Bīrūnī The papers were printed by the Foundation and circulated during the Congress

Besides the Sessions of the al-Bīrūnī International Congress, three distinguished international delegates graced the *Shām-i-Hamdard* (*) outside the Congress programme, at Karachi, Rawalpindi and Lahore

At Karachi, the *Shām-i-Hamdard* was held at the University of Karachi and was addressed by one of the world's foremost scholars, H E Dr Seyyed Hossein Nasr, Chancellor, Arya Mehr University of Technology, Teheran, Iran

At Rawalpindi, the Guest Speaker was Professor W Montgomery Watt of the University of Edinburgh, one of the most authoritative and prolific writers on *Islamiyāt*

At Lahore, the Guest Speaker was Professor Bertold Spuler of the University of Hamburg who holds a high position among the international authorities on Islam

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**Shām i Hamdard* a medico scientific, educational and cultural service of the Hamdard National Foundation, Pakistan, aims at revitalising the intellectual life of the Pakistani nation and give the people a sense of purpose and direction to their ideological urges and impulses It is a forum used by Pakistan's intellectuals for reawakening the nation by creating a vivid and lively interest in the assessment and resolution of the manifold problems facing the nation, and infusing in the people a sense of participation in the gigantic task of national reconstruction Initated in 1962, the forum is being held once every month in the leading cities of Pakistan The themes vary every year, the last three being EHTERAM or RESPECT, MUSLIM PERSONALITIES and NATIONAL PROBLEMS The English and Urdu addresses made at *Shām i Hamdard* have been published in separate volumes by the Hamdard National Foundation, Pakistan.

All these three personalities attended the al-Bīrūnī International Congress on invitation

EVALUATION

The al-Bīrūnī International Congress was an outstanding achievement in the educational and cultural history of Pakistan and justified the enthusiasm and indefatigable efforts of the organisers The generous academic and cultural co-operation of Dr Fuad Sarruf, President, Executive Board of UNESCO, the Vice-Chancellors of the Universities of Karachi, Peshawar, Islamabad, Panjab and Baluchistan, the Vice-Chancellor of the University of Engineering and Technology, Lahore, and of Professor Syed Husain Jafri, Chairman, Department of Religious Studies, American University of Beirut, made it objective and purposeful To give the al-Bīrūnī Millenary celebration an international flavour and form, Hakim Mohammed Said, the Chief Organiser, travelled to different countries, collecting ideas and opinions on the celebration, making contacts with scholars and orientalists and visiting libraries in search of manuscripts pertaining to the work of al-Bīrūnī

His effort not only succeeded in getting regional committees established in different countries, but also in getting a Resolution passed at the UNESCO Assembly that all UNESCO member-countries should commemorate the Millenary of the great Master suitably As a result, some countries have held meetings and conferences on al-Bīrūnī Thus for the first time a universal recognition and tribute has been paid to a Central Asian scientist

It is significant that the movement to honour the great Muslim scientist started in Pakistan and spread to other countries Knowledge knows no barriers of race or time It is the common priceless heritage of all, and, therefore, to be honoured and shared, wherever it is found

In holding this Congress, the sponsorship and participation of the Ministry of Education, Government of Pakistan, have been invaluable The Federal Minister of Education, Mr Abdul Hafeez Pirzada, the Secretary, Education, Mr Qudratullah Shahab and the Executive Secretary, Pakistan National Commission for UNESCO, Dr S M Zaman, extended their full interest, guidance and co-operation which contributed in making the Congress academically successful The official interest, cultural and financial contribution of UNESCO, particularly that of H E Mr Rene Maheu, Director-General of UNESCO, Dr N Bammate, Director, Cultural Studies Division, and Dr V Tiourine, Project Specialist, Central Asian Studies Project, contributed to the international character of the Congress and ensured its success

The Congress entailed a preparation of three years in its various phases such as personal contacts throughout the world, contacts through correspon-

dence, drawing up of programme, contacts with airlines, travel within and without Pakistan and accommodation of delegates in five-star hotels at the Congress centres etc During the Congress itself the reception, academic sessions, group transportation of delegates to the Congress centres, tour of historic places and centres of interest, social activities etc received minute attention and care from the Organisers The result was the winning of the warm and sincere friendship of all the delegates for Pakistan They can be looked upon as ambassadors of goodwill and witnesses to Pakistan's sincere desire for a peaceful, mutual co-operation with the nations of the world

This was achieved not merely through the academic work of the Congress, but through the numerous opportunities of meeting with and seeing the people of Pakistan at work—from different professions ranging from scholars to farmers—for national reconstruction, peace and progress They saw the everyday living of the people of Sind, of the Punjab and of the Frontier Provinces The bare rocks and hard terrain of the Khyber, the fertility and historicity of the Punjab and the cultural heritage of Sind, impressed them deeply Social occasions such as *Qawwālī* and wedding parties, religious experiences such as visit to the Data Darbar enveloped them in a sense of belonging to the place and the people "They formed themselves into a genuine family and many lasting friendships were forged during the brief period they shared " In a world of diversity, this sense of belonging, of unity, must be considered as one of the great contributions of the Congress

Another contribution to the al-Bīrūnī International Congress was the publication by the Hamdard National Foundation, of "Al-Bīrūnī's Book on Pharmacy and Materia Medica", being an English rendering of al-Bīrūnī's major work—the *Kitāb al-Ṣaydanah*-along with the original Arabic The publication is in two volumes, the first one consists of 684 pages of 18 × 22/4 size, and the second volume consists of 150 pages of the same size and being an introduction, commentary and evaluation of *Kitāb al-Saydanah* by Dr Sami Hamarneh of the Smithsonian Institution, Washington D C The painstaking work of Hakim Mohammed Said and Dr Rana Ehsan Elahie in collecting micro-films of the manuscripts of *Kitāb al-Ṣaydanah*, comparison and editing of an accurate text in Arabic, must be highly commended There is no doubt whatsoever, that this publication enriches the world of learning with a detail and wealth of information about the pharmacy and materia medica of the Sub-Continent during medieval times, proving a boon to those who carry out research in medicinal plants, free from prejudice and in a true scientific spirit

A third contribution of the Congress is the formation of the Institute of the History and Philosophy of Science, Pakistan, for the purpose of studying and conserving the vast corpus of knowledge in this field and promoting collaboration and co-operation among scholars and institutions in different countries engaged in similar pursuits It is visualised that the Institute will go a long way

in obtaining for us the benefit from the lessons of history

The Hamdard National Foundation, Pakistan, is deeply conscious of the opportunity it had for service in a socio-cultural and educational cause, and for the manifold blessings received thereby

THE INVITATION

Ref. No. HNF/ALB/72 *15th February,* 1972

Dear Distinguished Professor,

The greatest single factor of our moral, intellectual, spiritual and economic weakness is the apathy of our people—particularly noticeable in the younger generation This apathy stems partly from ignorance, partly from lack of interest On the one side the educated see the achievements and the results of these achievements manifested in the form of material prosperity which, if anything, seems to be exponentially progressing These achievements are presented before the world to constitute a dazzling array On the other side, we are blissfully unaware of the achievements of our ancestors The younger generation knows almost next to nothing, because of this hiatus between the past and the present, about the inventions and discoveries of the Old Masters This is why they are subject to a sort of complex, under which their collective ego lies buried, and they lose their own identity in the wake of this admiration

As you are aware, a Project for the study of the civilization of the peoples of Central Asia started at the General Conference of UNESCO in 1966 A group of experts met in Paris in 1967 and formulated the guidelines of the Project Different topics in the Project were allocated to the five countries of the region and Pakistan was allotted "History of the Development of Science" The University of Islamabad is proceeding with the UNESCO Project and has already in hand a scheme of studies and research related to the cultural history of mankind which naturally include contribution of Muslims to the development of science

The Hamdard National Foundation, Pakistan, which assists and supports in recording the history of ideas and scientific discoveries, and our cultural heritage, has been doing whatever it can to highlight the achievements of early Muslim geniuses The Millenary of Ibn al-Haitham was a link in the chain of this effort It has opened vistas for scholars and historians of science to make this great personality the subject of their research And now the Hamdard National Foundation, Pakistan, to co-operate with the University of Islamabad, in its Project, has decided to celebrate the Millenary of Abū Raihān Muhammad Ibn Ahmad al-Bīrūnī (973—1048) This remarkable son of Islam was a many-splendoured personality—theologian, historian, geographer, physician, physicist, astronomer, mathematician, logician and litterateur Al-Bīrūnī's scholastic and scientific achievements are so singular, so varied, so fundamental and his

personality so multifarious, that both demand serious and thoughtful study It is especially important to point out to the world how important al-Bīrūnī's role in the furtherance of science and the scientific spirit is, and how many of the currently accepted theories are owing to him, but whose discoveries have not been attributed to him !

To introduce a personality as versatile and as remarkable as al-Bīrūnī's, considerable planning and hard work is required A programme will have to be drawn up in order

1 to present and highlight the various and variegated aspects of al-Bīrūnī,

t 2 to enable the younger generation to realise and recognise the contributions of Old Masters to every branch of knowledge and science in order to ink the past with the present and march confidently forward to the future,

3 to invite the attention of scholars and writers to the achievements of al-Bīrūnī so that they may undertake detailed research on him as well as on other Muslim scholars and scientists, and

4 to resurrect old manuscripts of al-Bīrūnī for the purpose of printing them and have books, out of print, reprinted

In fact, the world has not discharged its proper debt of gratitude to al-Bīrūnī This situation we can redeem by taking advantage of printing and distribution and by requesting scholars and writers throughout the world to contribute material on al-Bīrūnī There is considerable material on al-Bīrūnī which demands research his monumental works, background, historical perspective, etc His works require annotation and exegesis and there is no doubt that there are many aspects of his personality that require further illumination The Millenary of al-Bīrūnī is proposed to be held from November 26th thru' December 12th, 1973, throughout Pakistan It is hoped that besides scholars and the intelligentsia of Pakistan, scholars from all nations will participate thus making the Millenary into an international forum We have to do a great deal in this behalf A start has been made with meetings held in Pakistan to plan the programme Attached are the proceedings of the meetings that are being sent to scholars throughout the world, with the request to take part in the Millenary of an illustrious personality

Dear Professor, this is obviously a gigantic task and to make it more and more purposeful and useful, your help and guidance will be of immense value I am sending you these lines to request you

(1) to send us guidelines,

(2) to contribute an essay, monograph or article on any aspect of the life and works of al-Bīrūnī,

(3) to point out sources from where possible help may be obtained, and

(4) to find whether there is any possibility of your being in Pakistan in November 1973 to personally participate in the celebrations

I am fully aware that I will have taken some precious time of yours for reading this letter, life-sketch of al-Bīrūnī and the proceedings of the meetings, in the ensuing pages, for which I beg your indulgence I hope that in the name of science and learning you will graciously send a reply to this communication and request

With best wishes,

Yours sincerely,

(HAKIM MOHAMMED SAID)

ABŪ RAIḤĀN MUḤAMMAD IBN AḤMAD AL-BĪRŪNĪ

An Outline of his Life and Works (973—1048 *A D*)

ABŪ Raiḥān Muḥammad Ibn Aḥmad al-Bīrūnī is probably the most prominent of those Muslim scientists, who characterize the Golden Age of Islamic science He was in fact, a versatile genius, who was equally at home in mathematics, astronomy, physics and other branches of knowledge and has left works of high scientific value in all these branches of study

Al-Bīrūnī, along with Abū 'Alī Ibn Sīnā, marks the culmination of that intellectual development, which had been taking place in Central Asia ever since Muslim ibn Qutaiba conquered it and annexed it to the Umayyad Empire Although Turkestan, and especially Khwārizm, where al-Bīrūnī was born, lay on the outskirts of the Islamic Empire—far removed from the literary activity of the metropolis of Baghdad—yet this region shows a remarkable growth of intellectual life, in which we can distinguish several distinct currents of thought In the sphere of religious sciences, the Traditionalists and Imām Nasāi made a particularly valuable contribution by compiling their celebrated Collections of Prophetic Traditions Under the patronage of the Samanid rulers of Bukhara began the revival of modern Persian literature, in which the composition of *Shāhnāmeh* by Firdausī stands like a distinct milestone When in 999 A D the Samanids were ousted by the Central Asian Turks, their mantle fell on the new Turkish dynasty, established at Ghazna in Afghanistan The most famous of the Ghaznavid rulers, Maḥmūd Yamīn Al-Dawlah sought renown in literature by bringing the chief writers of the day to add lustre and pomp to his court The scientific movement of this age is represented by Muḥammad ibn Mūsā al-Khwārizmī, Muḥammad ibn Aḥmad al-Khwārizmī (d 387 A H), the author of *Mafātih al-Ulūm*, and last but not least, Abū Raiḥān Muḥammad Ibn Aḥmad al-Bīrūnī

Al-Bīrūnī was born in *Dhul-Hijjah* 362 A H (September, 973) in a suburb of al-Khwārizm or modern Khīwā Here he enjoyed the patronage of an old local family, known as 'Āl-i-'Irāq, and he remembers with feelings of gratitude the favours he had received from this family After the fall of the house of Ā'l-i-Irāq, al-Bīrūnī had to leave his country, and went to the city of Ray, where he found a patron in the person of Shams-ul-ma'ālī, the ruler of Jurjān and Ṭabaristān But this monarch was a cruel man, and al-Bīrūnī could not feel at home at his court He, therefore, considered it advisable to return to Khwārizm, where he lived up to 1016 A D Here he came into contact with other scholars,

the most notable of them being Ibn Sīnā Al-Bīrūnī corresponded with him on some scientific questions, and the answers of the latter are still preserved in the British Museum

In 1016, when Sulṭān Maḥmūd conquered Khwārizm, Ibn Sīnā escaped to the court of the Buwayhid rulers in Persia, while al-Bīrūnī was brought by the conqueror to his court at Ghaznah, where he lived up to the time of his death in 1048 A D

His Works

Most of the historical and philosophical works of al-Bīrūnī are unfortunately lost, but his fame as a scientist securely rests on three masterly compilations

(i) *Āthār al-Bāqiyah anil-Qur'ūn al-Khāliyah* (The Surviving Monuments of Past Generations) It is a study in comparative chronology, embracing not only a description of the eras and festivals of various nations and religions but a good deal of historical information and curious observations on many subjects

The Arabic text of this work was edited by Dr Eduard Sachau and published at Leipzig in 1878, while the same scholar published its English translation a year later in London in 1879 This work was composed by al-Bīrūnī in 1000 A D (390 A H)

(ii) The attachment of al-Bīrūnī to the court of Ghaznah opened a new chapter in the literary career of al-Bīrūnī The epoch-making military expeditions of Sulṭān Maḥmūd had opened up Hindu India for the Muslims and al-Bīrūnī took advantage of Maḥmud's conquests to learn Sanskrit and study Indian literature After thirteen years of labour, he produced a work on India which in subject and scientific method stands unique in Arabic literature In his account of the religious and social ideas of the Indians and of their manners and customs, al-Bīrūnī is singularly free from religious and national prejudices and holds an even balance between uncritical admiration and unthinking aversion

Al-Bīrūnī's monograph on India, generally known as *Kitāb-ul-Hind*, was edited by Dr E Sachau and published in London in 1887 A D It was also translated into English by the same German Orientalist and published in London in 1888 There is also an *Urdu* translation of *Kitāb-ul-Hind*, which was published in two parts by **Anjuman-e-Taraqqi-e-Urdu** of Pakistan

Besides this, al-Bīrūnī translated into Arabic many Indian books, including the *Goga Sutra* and *Patanjali*, a copy of which has survived in Arabic

(iii) *Al-Qānūn al-Mas'ūdī fil-Haīy'ah wal-Nujūm* After the death of Sulṭān Maḥmud in 998 A D , al-Biruni continued his scientific work under the patronage of his son and successor, Sulṭān Mas'ūd He summarized the entire astronomical science of the Arabs in a comprehensive work and dedicated it to his patron by giving it the title of *al-Qānūn al-Mas'ūdi*, i e "The Canon dedicated to Sultān Mas'ud " It was supplemented by a shorter compendium on astrology

The selfless spirit, in which al-Bīrūnī carried on his literary activity, is illustrated by the following anecdote told by an authority quoted by Yāqūt al-Rūmī When al-Bīrūnī compiled his canon, Sulṭān Mas'ūd rewarded him with an elephant load of silver, but al-Bīrūnī broke with custom and returned it to the treasury, pleading his ability to do without it

A few years ago, the Arabic text of *al-Qānūn al-Mas'ūdī* was published at Hyderabad, Deccan, in 3 vols in 1954—56 A D

(iv) About the same time, al-Bīrūnī also composed a short treatise on geometry, arithmetic, astronomy and astrology in the form of a catechism It bears the title of *al-Tafhīm li Awa il Sinā'ah al-Tanjīm*, and was published along with an English translation by R Ramsay Wright in London in 1934

(v) Another useful and interesting work, which al-Bīrūnī wrote about the end of his life is his *Kitāb al-Ṣaydanah* It deals with medicinal herbs and drugs, and was translated into Persian by Abū Bakr bin 'Ali bin Othmān al-Kāsānī in India A copy of this Persian version is preserved at the British Museum, and has been described by H Beveridge in the Journal of the Royal Asiatic Society, London, 1902 A critical edition of the Arabic text of *Kitāb al-Ṣaydanah* is under the active consideration of the Hamdard National Foundation of Pakistan, located at Karachi

The introduction to this treatise on **materia medica** is very important, because it contains a number of observations by al-Bīrūnī which throw valuable light on his religious and national views His remarks show that he was an orthodox Muslim and did not harbour any agnostic tendencies, as had been suspected by certain modern writers At the same time, he had pronounced pro-Muslim and pro-Arab sympathies, and regarded the rise of the Persian Buwayhids as harmful to the best interests of Islam Al-Bīrūnī writes

> "Our Religion and our Empire are both Arabian, and the two are like twins The former is protected by the might of God, while the latter is aided by the Celestial Power Several subject races, especially the Dailamites, have revolted against them, but have not succeeded in their aims So long as the chant of the *mu'ezzin* continues to fall upon the ears of the Faithful five times a day and the ritual prayers are offered in Arabic under the leadership of the Imams, the citadel of Islam shall never be breached "

Al-Bīrūnī had a very high opinion about the Arabic language as a literary medium He writes in the same place

"Sciences from all over the world have been translated into the language of the Arabs and have been thus embellished and become attractive, and the beauties of the language have permeated their veins and arteries I speak from personal experience, because I was brought up in a language, in which it would be strange indeed to perpetuate a science Then I went over to Arabic and Persian as a stranger and a satire in Arabic would be more acceptable to me than a panegyric in Persian My statement will be borne out by any one who has seen a scientific work rendered into Persian how its literary grace is lost and it is deprived of its usefulness, for the Persian language is fit only for the legends of Persian kings and for the narration of entertaining tales "

(vi) During the reign of Sulṭān Maudūd the Ghaznavid, al-Bīrūnī wrote a treatise on mineralogy It is entitled *Kitāb al-Jamāhir fi Ma'arifah al-Jawāhir*, and has been edited by F Krenkow and published at Hyderabad, Deccan in 1936

The total number of works, which al-Biruni wrote, comes to about 180 Some of them are short treatises on special subjects, while others are major works embracing vast fields of knowledge Most of his works are lost, but the few that are still extant and have been published, are enough to show that al-Bīrūnī had an original mind and a critical spirit, which entitle him to a very high position among the Muslim scientists

We have no space here to give details about the valuable original contributions which al-Bīrūnī made to the various branches of human knowledge We shall, therefore, content ourselves with making just a brief reference to some of his scientific achievements

(1) Al-Bīrūnī calculated the circumference of the earth and arrived at a figure which is approximately the same as that of modern investigators These observations were carried out by him near a hillock known as Nandana in the tehsil of Pind Dadan Khan in Jhelum District The method employed and the theory on which it was based have been described by him in detail in his "*Canon Masoodicus*"

(2) Al-Bīrūnī gives us a clear description of the Indian system of notation, in which figures have values according to their relative positions

(3) Trisection of the Angle, and other problems which cannot be solved with the use of the ruler and the compass alone

(4) Simplified stereographic projection, similar to that first published by G B Nicolosi di Paterno in 1660 A D

(5) Accurate determination of latitudes and longitudes

(6) Discussion of the question whether the earth rotates on its axis

(7) Establishment of the fact that the speed of light is far greater than that of sound

(8) Determination of the specific gravity of 18 precious metals and stones

(9) Explanation, by means of the hydrostatic principle of communicating vessels, of the working of natural springs and artesian wells

(10) Description of various monstrosities including Siamese twins

(11) Observation of the number of petals in flowers flowers have 3, 4, 5, 6 or 8 petals but never 7 or 9

(12) Al-Bīrūnī held the view that the age of the Indus valley basin was a very long one He regarded it as an ancient sea-bed, filled up with alluvial soil

Al-Bīrūnī wrote all his works in Arabic, which was not only the scriptural language of the Muslims but was also the language of literature of science throughout the Muslim world in the age in which al-Bīrūnī lived The Arabic style of al-Bīrūnī is simple, direct and precise, and these qualities are eminently suited for scientific works, where accuracy should come before everything else His style shows that the writer was a mathematician by profession There is no padding, no superfluous words

The acquisition of Sanskrit on the part of al-Bīrūnī was a very valuable and significant accomplishment which proved of immense value to him in his study of Indian religion, philosophy and science It enabled him to go to the original sources of information and this fact lends unique authority to all that al-Bīrūnī wrote about India, its people and their beliefs His knowledge of Sanskrit also enabled him to translate many Indian works into Arabic and, more curiously, several Arabic translations from the Greek into Sanskrit

Although three major works of al-Bīrūnī have been edited, and several aspects of his scientific thought have been studied by a number of competent scholars, still much remains to be done in this field In the meanwhile, he deserves to be remembered with feelings of admiration for his scientific attainments and for his substantial contributions to human knowledge What makes the work of al-Bīrūnī all the more valuable is the fact that it was carried out in a strictly scientific spirit, and that it was not vitiated by any religious or national prejudices In this way, al-Bīrūnī proved to be a model investigator for the latter generations

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PROCEEDINGS OF THE MEETING ON AL-BĪRŪNĪ

Held under the auspices of Hamdard National Foundation, Pakistan, at Rawalpindi, on Wednesday, 4th August, 1971

The following attended the meeting

1 **Dr Raziuddin Siddiqui (President),** Ex-Vice-Chancellor, University of Islamabad, Islamabad

2 **Aziz, Prof Ghulam Rabbani,** Campbellpur

3 **Barq, Dr Ghulam Gilani,** M A , Ph D , Campbellpur

4 **Fatimi, Prof Qudratullah,** Islamic Research Institute, Islamabad

5 **Gulzar Ahmed, Brigadier,** 4-A, Gulistan Colony, Ayub Park, Rawalpindi

6 **Guraya, Dr Muhammad Yusuf,** Islamic Research Institute, Islamabad (now at Lahore)

7 **Masood, Prof Khawaja,** Gordon College, Rawalpindi

8 **Mohammad Khan, Colonel,** Director, Army Libraries, The Mall, Rawalpindi

9 **Said, Hakim Mohammed,** President, Hamdard National Foundation, Pakistan

10 **Salma Masood, Prof** Mrs , Principal, C B Girls College, Rawalpindi

11 **Zahoor Ahmed, Principal,** Campbellpur

Prior to the meeting, a working paper reflecting the personality, works and achievements of al-Bīrūnī, had been sent to all the members of the Advisory Committee In the light of this working paper the future course of action regarding the Millenary celebrations of this greatest Muslim scholar and scientist of Central Asia, had to be determined Hence no agenda had been fixed

The meeting commenced with a warm tribute paid by Hakim Mohammed Said to Dr Raziuddin Siddiqui for consenting to preside over the first meeting of the Advisory Committee He remarked on the good fortune of having

Dr Raziuddin Siddiqui, an eminent scientist, to preside over a meeting connected with another eminent scientist of the Middle Ages Hakim Mohammed Said also thanked other members, who attended inspite of distance and other preoccupations

The aims and objects of the celebrations of the Millenary were manifold The personality, the scientific observations and the work of al-Bīrūnī have received limited appreciation and recognition It is our duty and responsibility to make them more widely known Starting with our own country, our educated class, our youth and our intellectuals must be aware of the many-sided personality of al-Bīrūnī and take pride in his achievements The nation, inspired by his scholarship, should produce personalities like al-Bīrūnī An intensive study of his writings will open new vistas of research and contribute to a wider understanding and appreciation of his greatness With these objects in view, the programme of action has to be determined

Dr Raziuddin Siddiqui informed the members that in 1966 the General Conference of UNESCO was held, in which the whole project for the "Study of the Civilization of the Peoples of Central Asia" was started Thereafter in 1967, a meeting of experts was held in Paris in which the guidelines of the project were formulated Different topics in the project were allocated to the five countries of the region, and Pakistan was allotted "The History of Development of Science" It is hoped that with the generous support and patronage of the authorities and the co-operation of scholars and researchers both within the country and at the international level, the work will proceed with speed in the future The University of Islamabad has also in hand a scheme of studies and research related to the cultural history of mankind This will include contributions of Muslims to the development of science

LIFE OF AL-BĪRŪNĪ

He also informed the members that Dr Zabihollah Safa, an Iranian Scholar, is engaged in writing an up to date, comprehensive book on "Life of al-Bīrūnī" in the French language, with the co-operation of UNESCO Permission can be sought from Dr Safa, who is currently in Germany, through H E Dr Mashayekh Faridani, the Iranian Ambassador in Pakistan, to translate the book into English and *Urdu*

To justify this proposal, Hakim Mohammed Said pointed out that there is no authentic book on the life of al-Bīrūnī in *Urdu* Al-Bīrūnī spent more or less 40 years in the area which now comprises West Pakistan and south of Afghanistan, keeping close contact with the people of the area Under the present circumstances it is right and proper to give him due place and title in the scientific and philosophic world of Pakistan As a first step, the book of Dr Safa should be translated into *Urdu* The House agreed to this proposal

Dr Barq suggested that contact with Dr Safa should be made immediately and assistance to Dr Safa could be rendered by providing him with material which relates to the Sub-Continent

Professor Khawaja Masood suggested that a review of all the works of al-Bīrūnī should be made and a complete bibliography of his works should be compiled He also suggested that a collection of the writings of al-Bīrūnī and commentaries on his works should be made, with the intention of setting up an exclusive library, or at least a separate section on al-Bīrūnī in every library

Dr Raziuddin Siddiqui informed the House that the University of Islamabad is engaged in this very important task He expressed the hope that with the collaboration of all the five countries, who are members of the Central Asian Project of UNESCO, there would be a complete collection of the works of al-Bīrūnī in each of these countries

Prof Ghulam Rabbani remarked that other libraries of Pakistan could benefit from the work of the Islamabad University However, we should also be in constant search of al-Biruni's works and for this purpose we should put ourselves in contact with other countries

Dr Muhammad Yusuf Guraya suggested that contact with public and private libraries of Pakistan be made, so that a list of those books on al-Biruni available in Pakistan, could be drawn up

Dr Barq pointed out that private libraries in Pakistan have valuable collections He named many such libraries He suggested that a list of such libraries be prepared and thereafter contacted The House endorsed the views of Dr Barq

Hakim Mohammed Said informed the House that Prof Dr Muhammad Baqir of Lahore had already undertaken this task and is presently engaged in preparing a bibliography of al-Biruni

QĀNUN AL-MAS'ŪDĪ

Dr Raziuddin Siddiqui pointed out that this is a book of great significance and value It is desirable to translate this into an international language like English Therefore a committee of translators who are also scholars of English Arabic and mathematics should be set up for this purpose Dr Raziuddin Siddiqui offered to go through the translation on its completion

Hakim Mohammed Said suggested that a committee of the following may be constituted:

(1) Dr F D Qureshi,

(2) Professor Hamid Askari,*

(3) Professor Abdul Ghafur Chaudri, and

(4) Dr Shaikh Inayatullah

The House resolved that the English translation of *Qānūn al-Mas'ūdī* be taken in hand first The House, while thanking Dr Raziuddin Siddiqui for consenting to scrutinise the translation, also hoped that he would write its foreword

Professor Qudratullah Fatimi offered to prepare a monograph on "al-Bīrūnī as a Source of Pakistan History" The House appreciated the offer and requested Dr Fatimi to kindly start work on the monograph immediately

Dr Muhammad Yusuf Guraya made some important suggestions He said that the Millenary celebrations should not be restricted to the premier cities of Pakistan alone, but should be extended to the villages and farflung areas of Pakistan as well, where potential al-Bīrūnīs, Fārābīs and Ibn Rushds languish The Millenary celebrations should be motivated by the maxim "Discover Yourself" Seminars and symposia should be held in schools and colleges of cities, towns and villages Dr Guraya presented his proposals before the House

1. The main cause of our moral, social and economic stagnation is ignorance The salvation of our *Ummah* lies in the inspiration of Islam i e *Ijtehād* Through *Ijtehād* alone can be expected progress This task of *Ijtehād* can be performed by sensible and devoted "*millat dost*"

We are planning to hold the Millenary celebrations of a celebrated scientist—al-Bīrūnī Let us try to make these celebrations purposeful, objective and directed towards national reconstruction It is, therefore, necessary that the whole nation should take part in it The participation of the whole nation will be a revolutionary step in the direction of education, particularly when our present system of education is limited and not purposeful On such an occasion audio-visual aids can play an effective but limited role because they are accessible mostly to the urban population In these circumstances, it will be a great service to the nation if a country-wide programme is chalked out for the participation of the whole nation There is a great deal of undiscovered talent in the villages It is for us to discover such talent and bring it to light so that genius may not be

*We regret to announce that since writing this report, this eminent scientist has died

wasted Imbibing the good elements of Western civilisation, and keeping in mind our own, the coming generations can lead the nation to progress and prosperity To achieve this goal, the Hamdard National Foundation has chalked out a national programme despite its limited resources The programme is aimed at four sections of the nation

(1) The intelligentsia of the country,

(2) Universities, colleges and high schools,

(3) Middle and primary schools, and

(4) Arabic and Islamic *Madrassahs*

(1) The Hamdard National Foundation should get research articles and papers based on original sources, prepared by the '*Ulemā*, thinkers and research scholars Besides, various seminars should be held in different cities

(2) Each University of the country should hold seminars on al-Biruni in its own campus, with student-teacher participation All colleges and high schools should prepare thought-provoking papers on al-Bīrūnī, but not burdened with references and marginal notes Teachers and students should organise large meetings on al-Bīrūnī, to which the elite and intellectuals of the city should also be invited

(3) The papers are to be prepared by middle and primary students of the *Madrassahs* Al-Bīrūnī himself was a product of *Madrassah* training The students and teachers of *Madrassahs* are fortunate as they will be conversant with the languages in which al-Bīrūnī wrote It is important and necessary to make selected portions of al-Bīrūnī's works (especially the *Kitāb-ul-Hind*) a part of the *Nizamiah* system of education

Hamdard National Foundation, with the help of an Expert Committee, should prepare comprehensive guidelines on the salient features of al-Bīrūnī, on which the four sections of the population should work The question is how can this cross-section of the nation be persuaded to participate in this gigantic movement of intellect and learning? The participation of Universities depends on the consent of the Vice-Chancellors concerned They can hold large seminars with the co-operation of all the departments concerned

To carry out this movement successfully in high schools and colleges, the co-operation of the Directors of Education can easily be sought through the Secretary of Education of each province The same can be done in primary and middle schools The Directors of Education and local Inspectors of schools can do a great deal in this matter

Arabic and Islamic *Madrassahs* are of two kinds—those in East Pakistan are under one *Madrassah* Board In West Pakistan they are partly under the *Auqāf* Department and partly under various organisations We have to seek the co-operation of the Heads of the *Auqāf* Department and organisations

The scheme is unique and will be successful, if determination, hard work and co-operation will be forthcoming In implementing it, the Hamdard National Foundation will be rendering a great service to the nation

Brig Gulzar Ahmed and Prof Ghulam Rabbani suggested that we should seek full co-operation from all the Directorates of Education, and they should also be invited to take part in this movement They were of the view that direct approach to schools and colleges cannot prove fruitful (Hakim Mohammed Said endorsed these views and complained that on the occasion of the Millenary celebrations of **Ibn al-Haitham** recently the direct approach to these institutions did not prove successful)

Prof Ghulam Rabbani also suggested the following points

1 A booklet should be published depicting the life, personality and the achievements of al-Bīrūnī This booklet must consist of at least 20 pages It must be prepared with the help of Syed Hasan Barani's book "Al-Bīrūnī" and Islamic Studies Centre (Islamic *Dā'irat ul-Ma'ārif*) The printing must be in "*Khaṭṭ-i-Nasta'līq*" This booklet must be sent to all the educational institutions of Pakistan Prof Ghulam Rabbani offered his services for the preparation of the booklet

2 The Bengali translation should also be rendered for East Pakistan If Afghanistan is to be included in its list of circulation, then the booklet should be translated into Persian

3 In order to make the celebration most popular and nation-wide, we shall have to utilise the press and all other media of publicity The press, in particular, should be persuaded to publish articles on al-Bīrūnī, so that the literate class be introduced to the works and achievements of al-Bīrūnī

4 In Universities and educational institutes, a dynamic force of volunteer students be prepared who can be motivated and mobilised to shoulder the responsibility of celebration of the Millenary in a forceful manner

5 Al-Bīrūnī spent forty years of his life in the Sub-Continent Such excerpts from "*Kitāb-ul-Hind*" be collected as can be of special interest and emphasis

Professor Rabbani offered to collect the excerpts

6 The *Urdu* translation of "*Kitāb-ul-Hind*" be re-printed, so that those, who have only heard its name, may be able to read it for themselves

7 It is very difficult to get "*Kitāb-ul-Hind*" included in the curriculum of Arabic *Madrassahs* On the other hand nobody will have any objection, if it is included in the syllabus of Oriental Studies ('*Ulum-i-Sharqiah*) If it is done, then our purpose would be served

8 We should also approach the University teachers who are interested in this Millenary to enrich our knowledge of those subjects which were of interest to al-Bīrūnī

Dr Raziuddin Siddiqui once again stressed that the motivation of the Millenary celebrations should be to "Discover Yourself" He said it would be proper to inform each Regional Directorate of Education about holding the Millenary celebrations in detail and that we should also provide the necessary material to them in this connection

INTERNATIONAL SEMINAR

Hakim Mohammed Said asked whether the Millenary celebrations should be restricted to Pakistan or whether they should be given an international status The House resolved that it would be better if scholars at international level show their willingness to participate in it By holding an international seminar on al-Bīrūnī, the scope would be widened

DATE OF THE MILLENARY CELEBRATIONS

The House resolved that the Millenary should be held in October 1973, with the provision that Hakim Mohammed Said could revise the dates, keeping in view other international seminars to be held that year in other countries

The meeting concluded with a vote of thanks to the Chair

PROCEEDINGS OF THE MEETING ON AL-BĪRŪNĪ

Held under the auspices of Hamdard National Foundation, Pakistan, at Lahore, on Friday, 6th August, 1971

The following attended the meeting

1 **Mr Justice S A Rahman** (President), (Retd) Chief Justice of Pakistan, 65, Main Gulberg, Lahore

2 **Abdul Hamid, Dr.**, 80-B, Gulberg II, Lahore

3 **Abdul Rashid, Lt -Col Khwaja**, Administrator Mayo Hospital, Lahore

4 **Baqir, Dr Muhammad**, Principal, University Oriental College, 12-G, Model Town, Lahore

5 **Ejaz Hussain, Hakim**, Hamdard National Foundation, Anarkali, Lahore

6 **Hamid Ahmad Khan, Prof**, Former Vice-Chancellor of the University of the Panjab, 5, Begum Road, Lahore

7 **Hamid Askari, Prof**

8 **Inayatullah, Dr Shaikh**, 12, Jail Road, Lahore

9 **Kalim, Mr. Makeen Ahsan**, Editor, Daily "Mashriq", Nisbet Road, Lahore

10 **Khurshid, Dr Abdus Salam**, Head, Dept of Journalism, University of the Panjab, 10, Salik Road, Muslim Town, Lahore

11 **Laeeq Ahmad, Mr.**, Controller, West Pakistan Engineering University, Baghbanpura, Lahore

12 **Manzoor Hussain, Prof**

13 **Muhammad Usman, Prof**, Principal, Government College, Baghbanpura, Lahore

14 **Nayyar Wasti, Hakim Ali Ahmed,** Qaumi Dawakhana, Masti Gate, Lahore

15 **Namus, Dr. M S.,** 9-10, Multan Road, Nawankot Chowk, Lahore

16 **Nasir, Dr Naseer Ahmed,** Secretary, Urdu Encyclopaedia of Islam, University of the Panjab, Lahore

17 **Qureshi, Mr Bashir,** News Editor, P P I, McLeod Road, Lahore

18 **Qureshi, Prof Muhammad Fazl-ud-Din,** 138-N, Samanabad, Lahore

19 **Rashid Ashraf Nadvi, Hakim,** Shifakhana Tibbia College, Multan Road, Lahore

20 **Sabuhi, Mr Ashraf,** Hamdard National Foundation, 3-Fane Road, Lahore

21 **Said, Hakim Mohammed,** President, Hamdard National Foundation (Pakistan), Karachi

22 **Salah-ud-Din, Dr Khwaja,** Head, Department of Chemical Technology, University of the Panjab, Lahore

23 **Waliullah Khan, Mr Muhammad,** 26, Hearn Road, Krishan Nagar, Lahore

24 **Waqar Ahmad Sheikh, Mr**

25 **Zaidi, Professor Ali Nasir,** Director, Panjab Text-book Board, 83, Shadman Colony, Lahore

Hakim Mohammed Said explained the purpose of the meeting, and stated that the first meeting of the series was held in Rawalpindi on 4th August, 1971, under the Chairmanship of Dr Raziuddin Siddiqui He asked the House to take decisions on certain pertinent questions, for example, whether the Millenary of al-Bīrūnī was to be held on an international scale, what should be the dates and who should play the leading role and accomplish the task Hakim Said explained that UNESCO had embarked on a vast programme to bring out the valuable work done by the Muslim scholars from the 9th to 13th Century A D in various fields and that five countries of the world were participating in this programme They have each taken responsibility for conducting research in particular branch of learning, for example, Indian scholars are working on philosophy, Iran on languages, Russia on art, while science has fallen to the share of Pakistan Other countries are also expected to co-operate in this

project The first session in this connection was held in the Islamabad University during September, 1970

Dr Baqir, explaining the background of the project, stated that UNESCO provided the programme to the Government of Pakistan during the period 1967-68 The Government of Pakistan entrusted it to Dr Raziuddin Siddiqui Dr Siddiqui in turn sought the help of the University of the Panjab through Professor Hamid Ahmad Khan, who kindly held a few meetings for the purpose during 1968 UNESCO wanted a working paper on the project, and so the representatives of all the five countries assembled in Islamabad, including two scientists from India Al-Bīrūnī is an important scientist of the period mentioned above Russia insisted on assuming this responsibility Hakim Mohammed Said also took part in the deliberations as a delegate from Pakistan, besides Dr Inayatullah and Prof F D Qureshi It was decided that monographs should be written on al-Biruni, and UNESCO may be approached for guidance and help As for India, it was mentioned that this work was being done in Madras and they had already compiled a book on philosophy, but they have not mentioned any Muslim scholar in their book, partly because Pakistan did not supply them any information whatsoever

The House thanked Hakim Mohammed Said and appreciated his efforts that he always came forward to perform such tasks and accepted heavy responsibilities without asking for funds from any quarter Dr Baqir pointed out that UNESCO had asked Pakistan to print unpublished works of al-Bīrūnī Hakim Said informed the House that the Islamabad meeting had decided that the *Qānūn-al-Mas'ūdī* of al-Bīrūnī should be translated into English He further said that the Hamdard National Foundation would consider the publication of its English version

Hakim Nayyar Wasti presented al-Bīrūnī as a physician, and told the House that he had seen several unpublished works of al-Bīrūnī in Turkey, and that he was impressed most by one of his books, viz *Kitāb al-Ṣaydanah*, a photostat copy of which was available with him Prof Hamid Ahmad Khan pointed out that Prof F D Qureshi had already translated *Kitāb al-Ṣaydanah* in *Urdū* under the auspices of the University of the Panjab and that its Persian translation was also available with him Dr Baqir suggested that the manuscript may be given to the Hamdard National Foundation for publication Professor Hamid Ahmad Khan pointed out that Professor Qureshi's *Urdū* translation of *Kitāb al-Ṣaydanah* was the property of the University of the Panjab, but it was not known when the University would be in a position to print and publish it It is, therefore, necessary that the issue be settled with the authorities of the University, if it is desired that Professor Qureshi's *Urdū* version of *Kitāb al-Ṣaydanah* be published on the occasion of the Millenary celebrations of al-Bīrūnī

Hakim Said suggested that the translation should be printed side by side

with the original text, so that chances of misunderstanding may be minimised He further added that Dr Zabihollah Safa, an Iranian scholar, now in Germany, was compiling the "Life of al-Bīrūnī" in the French language He also mentioned that the works of al-Bīrūnī were being collected in the Islamabad University

About the date of the Millenary it was unanimously decided that it should be celebrated in November, 1973, the exact dates to be notified later by Hakim Mohammed Said Schools, colleges and other educational institutions will also be asked to take part in the deliberations, for which the Regional Directors of Education will be approached Foreign countries will also be invited to send their delegates Lt Col Rashid mentioned that a similar function was held in Hyderabad, Deccan, in 1947, and three issues of "Islamic Culture" were published Dr N A Nasir added that his Institute had all these volumes in its library

At this juncture, Prof Hamid Askari read out an introductory note on al-Bīrūnī and mentioned that Hakim Said, at the time of celebrating a similar function on Ibn al-Haitham, had promised to build a tower if and when possible at Nandana, District Jhelum, where al-Biruni performed his celebrated experiment to measure the circumference of the earth

Mr Waliullah Khan described the area around Nandana, and told the House that he had himself been there and a few photographs of the area were available with him Hakim Mohammed Said asked the members, if there was any book which the Hamdard National Foundation might publish in *Urdu* on al-Bīrūnī Mr Waliullah Khan suggested *Jughrafiah-i-Hind*, but this book contains many mistakes which al-Bīrūnī had made about the location and direction of certain places and, therefore, marginal notes and descriptive additions were necessary, while compiling the book Dilating on the subject, he added

"Leaving aside the historians of Alexander and the exploration of the course of the River Indus by Scylax of Caryanda at the command of Darius I during the period from 515 to 509 B C, perhaps al-Bīrūnī is the earliest scholar who has so extensively and authentically written on the various and varied subjects like history, politics, geography, religion, Sanskrit literature, Indian philosophy, science and ethnology, astronomy and social structure of Indo-Pakistan in his books *Tārīkh-ul-Hind* and *Qānūn al-Mas'ūdī*, which he compiled during the period from 1030 to 1033 A C

"Unfortunately, a thorough and objective study of these works has not been made so far It is, therefore, suggested that these works be re-published with text and translations into *Urdu* and with footnotes added after a thorough study of the books by a Board consisting of historians, experts on ancient geography, both physical and political, Sanskrit literature and archaeology

"A full itinerary of the places, which he visited or described should also form a part of this work

"Al-Bīrūnī spent some ten years (H 411 to 420) of his precious life in Indo-Pakistan, and did an excellent literary and academic research and human service to this Sub-Continent It is, therefore, appropriate that a suitable memorial in the form of a library, observatory or hospital be established to commemorate his services to mankind at some suitable place"

Mr Justice S A Rahman suggested that an English translation of *Kitā b al-Ṣaydanah* may be produced with the help of its Persian and *Urdū* versions Hakim Said showed his eagerness and readiness for this work, and said that the Hamdard National Foundation would be willing to publish it in English as well as in *Urdū* Prof Hamid Ahmad Khan suggested that a monograph should also be printed in *Urdū* that may serve as an introduction to al-Bīrūnī He further suggested that symposia must be held in various languages during the year 1973, and a paper should be published on each symposium, and, if possible, a collection be published at the end in *Urdū* Hakim Said suggested that certain topics should be selected on which scholars may be invited to write their monographs and papers Prof Hamid Ahmad Khan said that scholars of other countries should also be associated with this scheme It was unanimously decided that

(i) the titles of all the books, written by al-Bīrūnī, should be collected,

(ii) monographs should be prepared, and

(iii) research papers should be written

On a suggestion from Dr Muhammad Baqir, it was agreed that an exhaustive bibliography of the writings of al-Bīrūnī and the works on al-Biruni, in all languages, be published Dr Baqir was entrusted with the preparation of the manuscript The House showed its concern at the indifference of people towards this great scholar, so much so that even the location of his grave was not known to this day Dr Baqir desired that a relief map, in plaster, to scale, be made after locating the birth place of al-Bīrūnī, which according to Ghazanfar, was a suburb of Kath, the capital of Khwarizm This was agreed to Dr Baqir was asked to locate the place on the map, and Mr Waliullah Khan was entrusted with the task of executing the plaster model in relief Dr Baqir also accepted the responsibility for preparing a map showing the travels of al-Bīrūnī and tracing the itinerary from his works with chronological information

Dr Baqir suggested the printing of *Kitāb-ul-Hind*, with maps and diagrams Mr Waliullah Khan and Prof Hamid Ahmad Khan supported the idea

Dr Baqir said that the *Urdū* translation of this book, published by *Anjuman-e-Taraqqī-e-Urdū* in two volumes, was available with him, but it is necessary that it should be published with marginal notes, maps and diagrams, so that all the mistakes may be corrected

It was agreed that Dr Baqir would edit the book by

(a) writing an introduction,

(b) adding detailed marginal notes, and

(c) adding maps and diagrams, where necessary

Dr Baqir was asked to take help from Mr Waliullah Khan in drawing maps and locating obscure places mentioned in the book

At this stage, Lt-Col K A Rashid recorded the following points

> "While speaking of the translation of *Kitāb-ul-Hind* I suggest that the annotations of Dr Sachau to its English translation have to be very carefully studied and scrutinized as he has tried to create misunderstanding about certain information recorded by al-Bīrūnī For example, I remember one of his remarks which is tantamount to saying that al-Biruni did not understand the Hindu religion, because he was talking about the concept of the unity of God in the *Gita*, which is nowhere to be found! At the time of al-Bīrūnī there were 13 types of *Gitas* in vogue This fact has been mentioned by Mr Bal Ganga-dhar Tilak in his commentary on the *Gita* (*Gita Rhasya*) that other *Gitas* did exist besides the one prevalent today, called the *Bhagvat Gita* Similarly, many other criticisms levelled unjustifiably against al-Bīrūnī by Dr Sachau have to be examined"

Prof Hamid Ahmad Khan referred at this juncture to the fact that Dr Javed Iqbal had mentioned in his thesis, while working for his doctorate in Cambridge, that the basic concept of Pakistan was present in *Kitāb-ul-Hind* All the members appreciated this point, particularly because al-Bīrūnī had himself lived with Hindus in India and had studied their habits and prejudices Dr N A Nasir felt sorry that philosophy had gone to the share of India and that everything was fair in their mythology We must uncover the philosophy of Hindus as expounded by al-Bīrūnī and publish a booklet exclusively on this subject

All the members asked Dr N A Nasir to write this booklet himself, which might be sent to UNESCO, if the Government of Pakistan permitted Dr Nasir accepted this responsibility

Prof Hamid Askari reiterated that the House was ignoring the scientific works of al-Bīrūnī, only three in number, viz, "*Āthar al-Bāqiyah*", "*Kitāb-e-Tafhīm*" and "*Tahdid*" which contains the experiments performed by al-Bīrūnī at Nandana Prof Manzoor Hussain also suggested that the mathematical achievements of al-Bīrūnī should not be lost sight of We must compile a book, which may mirror the scientific acumen which this great scholar was endowed with We can compile a book, in which al-Bīrūnī may be presented as a mathematician, a physician, and a scientist

Mr Justice Rahman suggested that scholars in English and *Urdū* should co-operate with Dr Inayatullah who was a scholar of the Arabic language Dr Inayatullah consented to work jointly with the experts given to him

Mr Waliullah Khan proposed that a short article be written and published on al-Bīrūnī, so that the public at large may know him

After some discussion, it was decided that Hakim Nayyar Wasti, Prof Qureshi and Dr Inayatullah will work jointly on "*Kitāb al-Ṣaydanah*" Hakim Said again showed his interest in this book, and so this committee was formed for this work The House was given the responsibility of suggesting the names of foreign scholars, who may be invited to participate Our embassies abroad may also prove helpful in this connection

Mr Laeeq Ahmed suggested that

"1 In order to make our public aware of the importance of the works of al-Bīrūnī, we should organise a mobile exhibition depicting the life and works of al-Biruni The exhibits should comprise photographs, charts and working models of the experiments carried out by al-Bīrūnī in his time, preferably a comparison of the theories and ideas of al-Bīrūnī with the modern concepts, where the two are basically similar This exhibition should move around the educational institutions in Pakistan to prepare our public to participate in the celebrations of the Millenary with interest

"2 A lecture kit should be prepared giving a brief life-history and the different fields in which al-Bīrūnī made his contributions This kit should be supplied to all major educational institutions in Pakistan with the request that one of the teachers from each institution should deliver a lecture to the students of his institution, and the lecture should be based on the kit supplied to him by the Hamdard National Foundation, Pakistan "

At this point Mr Makin Ahsan Kaleem suggested that since the exhibition has to be necessarily restricted to certain areas only, as a compensatory measure we should write and publish booklets in easy language not only for children but also for the less educated adults

Mr Ishfaque Ahmed, Director, Central Urdu Board, who could not participate in the meeting, very kindly sent the following remarks to be included in the proceedings

(i) In my view, the most important aspect of research is that al-Bīrūnī's unpublished works should be published The first step lies in the search for bibliographical and informative material A brief list of the manuscripts of al-Bīrūnī's works is given by D J Boilot in the **Encyclopaedia of Islam** (Revised edition, Vol-I) Hakim Nayyar Wasti is correct in saying that manuscripts of al-Bīrūnī's works are preserved in the libraries of Turkey I am quite hopeful that, if a concerted search is made for manuscripts, it is bound to result in success, and several manuscripts will be published for the first time There is a priceless collection of Oriental manuscripts in the Top Kapi Sarayi Museum Library A detailed list of the Persian manuscripts of this library has been published in four volumes and is still incomplete From this list it is possible to obtain the relevant material Also, from the Aya Sofia and other libraries of Turkey, it is possible to procure manuscript material that bears relevance to research on al-Bīrūnī There are several manuscripts which have not so far been published, and only parts of these manuscripts have come to light, or their translations have been published in Western languages These treatises, articles and translations could prove to be considerably useful, especially as they illumine the obscure corners of al-Bīrūnī's life and thought

(ii) A detailed bibliography on the life and works of al-Bīrūnī should be compiled Whatever has been written or done in English in Pakistan and abroad is partly known to research-workers in Pakistan, but what is less known is the new material unearthed in French and German In my view, therefore, the work done on al-Bīrūnī, which does not take cognizance of this aspect, will be incomplete this, at least, is my view Therefore, an annotated and detailed bibliography on and about al-Bīrūnī should be compiled, and it should include the material in the oriental and occidental language Besides, reference in English, those in the other European languages should be included along with translations, so that those unfamiliar with them may be able to grasp their significance D J Boilot prepared a bibliography along these lines, and the complete reference is as below

L'Oeuvre d' al-Bīrūnī Essai Bibliographique (Melanges de l'Institut Dominicain d'Etudes Orientales du Caire, Vol ii pp 161—256, Vol iii *pp* 391—96)

This list, however, needs revision, since several references are missing in it If the new bibliography is prepared on the basis of Boilot's bibliography, several problems will be solved automatically

(iii) The manuscripts of al-Bīrūnī's works are present in almost every major library The holdings of most of these can be easily procured In these lists of the holdings, the contents of each manuscript and its other characteristics are described in considerable detail These lists of holdings should serve as the basis for the compilation of a detailed bibliography One of the most obvious advantages of such a scheme is that a worker delving into the material on al-Bīrūnī will be able to locate holdings on al-Bīrūnī

(iv) German and English translations of the *Kitāb Tā'rīkh al-Hind* (The Book of the History of India) were published by Dr Sachau An *Urdu* translation of this work was published by the *Anjuman-e-Taraqqī-e-Urdu* (India) in two volumes, but this translation is defective from several angles What is now required is an altogether new translation into *Urdu*, but this translation should be direct from Arabic This translation should contain explanatory notes on places and personalities, and other obscure points Sachau's annotations might serve as a guide, but, at the same time, it should be our effort to incorporate new information about al-Bīrūnī

Similarly, another remarkable book by al-Bīrūnī, *Qānūn al-Mas'ūdī*, should be translated into *Urdū* The text of the book has been published in three volumes at Hyderabad (Deccan) Some time back, I arranged for the translation of the book into *Urdū* on behalf of this Board I did everything within my power to see that the translation was completed as early as possible, but owing to the advanced age of the translator and his failing health, the translation has lagged behind and only 30 manuscript pages have been received from him And now for quite some time the work is completely at a standstill If you could help us with the execution of this work, I should feel highly grateful

(v) In order to introduce al-Bīrūnī to the public, it is essential that the usual sources of communication, e g , television and radio, should be employed and programmes on al-Bīrūnī presented in clear and easy language In addition, it is also desirable that exhibits on al-Bīrūnī should be arranged in the bigger towns of Pakistan

A few points, suggested by Mr Bashir A Qureshi about one of the most important aspects of al-Bīrūnī's life, are given below

"Al-Bīrūnī worked in the Indo-Pakistan Sub-Continent to strengthen the foothold of the Muslim conquerors here That implies no secret mission He "infiltrated" into the culture and love of the people inhabiting the area and paved the way for Islam's intellectual and cultural conquest He was an

enlightened explorer of this region, who served the cause of the *millat* by opening up to it a region which was engulfed in the gloom of obscurantism

What is most relevant to us in the present context in Pakistan is that while his observations on Hindu philosophy evince an attitude of appreciation, his experience of the Hindu society, with which his *Kitāb-ul-Hind* is interspersed, are very bitter

He says the Hindus are radically opposed to us in religion and social habits They scare away their children from Muslim dress and manners, and ascribe it all to what they describe as "anti-deity" or the devil They would fain torture a Muslim to a painful death, simply because of this concept They look upon him as a polluted individual, who is an untouchable They would not partake of anything which has been touched by fire or water belonging to a Muslim Their social environment and traditions are inimical to Islam and its followers

Muslim conquerors, like Muḥammad bin Qāsim and Maḥmūd of Ghaznah, never forced any Hindu to become a Muslim Only those were taken into the fold of Islam who accepted the faith through a real change of heart In spite of this (or perhaps because of this, he subtly suggests), the Hindu mind became all the more hostile towards the Muslims and their faith

Self-centered, self-pampered, these people, to say the least, are simply naive He says that he is by no means trying to be satirical, but is merely making an objective appraisal of their character from what he has observed of their life, manners and ethos It is no exaggeration to say that they think that if there are any human beings extant it is they, if there is any country it is theirs, if there is any knowledge or culture or civilisation, it is theirs and theirs alone They even refuse to believe that any cities besides theirs exist, if they do, no human being inhabits them, or if at all there are human beings they have no culture or fund of knowledge Whosoever tells them about such cities or their people or their culture, they would give him the lie

Let us not forget that al-Bīrūnī experienced a great difficulty in presenting the Muslim empire-builders of this Sub-Continent with a candid picture of the Hindu mentality Pakistan will not only be vindicating the truth of her rationale through such a dissertation, but will also be explaining to the future generations of the nationals of this Islamic State the policy-line they had to adopt *vis-a-vis* India

Comparisons are not necessarily odious For us al-Bīrūnī is of the type that playwright Marlowe, explorer Gordon, and soldier T E Lawrence have been to the British Empire He was certainly their type, but was by far greater in his intellectual horizon and cultural achievements Not just a pride in him, but

a close study of his important observations is the minimum homage we can pay to him"

The points, on which general agreement was reached, are given below:

1. The writing of monographs
2. Exhibition with maps and models
3. *Kitāb-ul-Hind* to be published six months in advance

A committee with the following members was, therefore, formed to get this task done

1. Dr Abdus Salam Khurshid — Convener
2. Dr Manzoor Hussain
3. Dr Khawaja Salah-ud-Din
4. Hakim Nayyar Wasti
5. Prof Rafique or Prof Fayyaz from the Sociology Department, Panjab University, Lahore
6. Prof Hamid Askari
7. Dr Abdul Hamid
8. Dr Naseer Ahmed Nasir
9. Mr Waliullah Khan

PROCEEDINGS OF THE MEETING ON AL-BĪRŪNĪ

Held under the auspices of Hamdard National Foundation, Pakistan, at Karachi, on Thursday, 19th August, 1971

The following attended the meeting

1 **Qureshi, Dr Ishtiaq Husain** (President), Former Vice-Chancellor, University of Karachi, Karachi

2 **Aftab Hasan, Major,** Director, BCC & T, University of Karachi, Karachi

3 **Azmat Ali,** Editor, Karwan-e-Science, Karachi

4 **Barkati, Masood Ahmed,** Hamdard National Foundation, Pakistan, Karachi

5 **Feroze, Dr Mohammad Rashid,** C/o Mr Muhammad Sa'ud, University of Karachi, Karachi

6 **Ghafur, Abdul,** Director, Adarts Ltd , Karachi

7 **Hamid Mahmud, Dr Syed,** Head, Department of Zoology, University of Karachi, Karachi

8 **Hashmi, Dr Yousuf Abbas,** Professor of Islamic History, University of Karachi, Karachi

9 **Ilyas, Dr Hafiz Mohammad,** Chief Executive, Hamdard Waqf Laboratories, Karachi

10 **Khalid Latif,** Publicity Executive, Hamdard Waqf Laboratories, Karachi

11 **Mahmud Husain, Dr ,** Vice-Chancellor, University of Karachi, Karachi

12 **Manzoor Ahmed, Dr ,** Professor of Philosophy, University of Karachi, Karachi

13 **Mazharul Haq, Prof Dr ,** Professor of Pharmacology, Jinnah Post-graduate Medical Centre, Karachi

14. **Minai, Idrees Ahmed,** Dy Managing Director, National Bank of Pakistan, Karachi

15 **Moinul Haq, Dr Syed,** General Secretary, Pakistan Historical Society, Karachi

16 **Naqvi, Dr. Sibte Nabi,** D-146, Block B, North Nazimabad, Karachi-33

17 **Niazi, Maj Dr. G.H K,** Vice-Principal, College of Eastern Medicine, Karachi

18 **Qadri, Prof Dr Afzal Husain,** Dean, Faculty of Science, University of Karachi, Karachi

19 **Qureshi, Iqbal,** A P P, Karachi

20 **Riazul Hasan, Dr,** 4-A/6/13, Nazimabad, Karachi

21 **Riazul Islam, Dr.,** Professor of History, University of Karachi, Karachi

22 **Said, Hakim Mohammed,** President, Hamdard National Foundation, Pakistan, Karachi

23 **Sa'ud, Muhammad,** Research Scholar, University of Karachi, Karachi

24 **Yasin, Hakim Mohammed,** Secretary, Hamdard Clinics, Karachi

25 **Zuberi, Hakim Naimuddin,** Hamdard National Foundation, Pakistan, Karachi

26 **Zuberi, Masarrat Husain,** Chairman, Monopoly Control Board, Government of Pakistan, Karachi

Prior to the meeting, a working paper reflecting the personality, the works and the achievements of al-Bīrūnī had been sent to all the members of the Advisory Committee In the light of this working paper, the future course of action regarding the Millenary celebration of this greatest Muslim scholar and scientist of Central Asia, had to be determined Therefore, there was no fixed item on the agenda for discussion

Hakim Mohammed Said said that Abū Raiḥān al-Bīrūnī was a great scientist, historian, geographer and scholar of the East Hamdard National Foundation has decided to commemorate his Millenary in a befitting manner

Dr I H Qureshi then read out the proceedings of the previous meetings

held at Rawalpindi and Lahore Dr. Qureshi emphasised that utmost care be taken while editing and translating the works of al-Bīrūnī into English and *Urdū* The translation should be based on the original texts He observed that sometimes translations of the works of Muslim scholars are shabby and below the standard, with the result that we are ridiculed by Western scholars He stressed that '*Kitāb-ul-Hind*', '*Kitāb-ul-Tafhīm*' and '*Qanūn-al-Mas'udī*' should be translated either in *Urdū* or English diligently, and in this connection, papers should also be prepared by the scholars of Arabic and Persian languages

Major Aftab Hasan remarked that for such a gigantic project we have neither the resources nor the materials By resources, he did not mean financial resources alone He said that no book on al-Bīrūnī existed in *Urdū*, except the monograph written by Syed Hasan Barani of Aligarh Even the book of Dr Zabihollah Safa on the life of al-Bīrūnī (which is being written) is in French All these disadvantages should be kept in mind, while compiling the book

Dr I H Qureshi said small booklets can be prepared, but extensive research cannot be done in the true sense of the term in this short span of time

At this point, Dr Manzoor Ahmed said the time limit is not important to us We shall carry on the work, even after the Millenary celebrations During the period, work on solid grounds can be done The work of translating the important books of al-Biruni can be continued even after the Millenary For this purpose, scholars can be approached and their services obtained, provided that the necessary material is supplied to them Comprehensive books on the subjects of philosophy, science and geography should be compiled, so that each of them may be recognised as authentic

At this juncture, Dr Riazul Islam remarked that only such work should be undertaken as can be successfully completed A competently accomplished task on a moderate scale would bring more credit than an ambitious programme executed imperfectly

The translation of *Qānūn al-Mas'ūdī* should be undertaken, only if scholars of the requisite qualifications are available

Mr Muhammad Sa'ud suggested that for the convenience of research scholars, a list of topics, after it is thoroughly finalized, should be sent to them with the request either to select anyone out of them or to choose their own for writing a complete thesis on it If it is done, Hamdard National Foundation should be informed of their choice

Scholars should be requested to write papers on al-Biruni with the help of his original works or of sources in those languages in which the translations have been rendered These scholars should not discuss the life history of al-Biruni

in their papers, except where it is necessary in the context of the subject-matter of the paper.

There are many booklets on al-Bīrūnī dealing with the various branches of knowledge Some of them can be selected for the purpose of translating them, both in English and *Urdū* If it is done, it would be of great value to the public.

An authentic book on al-Bīrūnī should be compiled keeping in view the work which has already been done and is being done on al-Bīrūnī in the other parts of the world and with the help of his own original works In this book, there must be a separate chapter which should discuss exclusively and specifically the influence that al-Bīrūnī has exerted on later periods and his theories concerning the planetary system in the light of the modern astronomical science

Dr Mazharul Haq suggested that an essay competition be held, and the general public be invited to take part in it After scrutinizing these essays, comprehensive record should be maintained of al-Bīrūnī's life

Dr Mahmud Husain said that it is not easy to conduct extensive research on the books of al-Bīrūnī He regretted that we do not have authors on the history of science in our country In the field of the history of science, credit goes to Western scholars who have made substantial contributions to this branch of knowledge He suggested that a detailed account of al-Bīrūnī's books should be prepared, so that people may understand and appreciate their contents.

QANUN AL-MASUDI

Selected books of al-Bīrūnī should be edited and translated, e g *Qānūn al-Mas'ūdī* This would be a solid contribution to the cause of scholarship Dr Mahmud Husain also expressed his deep sense of appreciation that Hamdard National Foundation is willing to publish this book

INTERNATIONAL SEMINAR

Regarding the holding of an International Seminar, the venue could be Karachi and seminars could also be arranged in other selected cities of the country

Mr Masarrat Husain Zuberi observed that a period of 5-6 years is required to complete this project The holding of an International Seminar although difficult and painstaking, is yet possible Much in advance of the Seminar, the topics of the papers to be read should be determined so that the papers may be incorporated in the original research work

Dr. Manzoor Ahmed suggested that before holding an International

Seminar, extensive correspondence be made all over the world Mr M H Zuberi added that UNESCO should be requested to supply a list of scholars of international repute, so that they might be invited to attend this proposed Seminar Besides, UNESCO should also be requested to supply a timetable of activities so that it may be convenient to fix the dates according to it

Dr I H Qureshi held that an International Seminar involves a great deal of financial resources If it is held, then the papers should definitely attain a high standard of research If it is not held, then the finances should be spent on more extensive research work He wanted to know whether Dr Safa's book was ready or not, if not, how much time will be taken to complete it Hakim Mohammed Said undertook to find out when Dr Safa's book would be ready

KITĀB AL-ṢAYDANAH

Major G H K Niazi added that in view of the shortage of authors on the history of science, lack of resources and shortage of time, we should try to prepare one short book giving a brief sketch of al-Bīrūnī's life, for the common man to understand and a second comprehensive book at a higher intellectual level

Mr A Ghafur stated that the entire thinking on al-Bīrūnī seems to be focused on rediscovering this many-sided great Muslim genius only for the benefit of the scholars of Pakistan The younger generation seems to have been ignored

We need hardly stress the importance of introducing the old Muslim Masters to the youth of Pakistan It is generally they who are overawed by the Western thinkers and philosophers Why not catch them young and produce some literature, say at least one pamphlet in *Urdū*, in which the personality and achievements of al-Biruni are described in easy language This will inspire many of them to take interest in what the Hamdard National Foundation will do on the serious and technical side

Although we have limited resources, yet we intend to carry out this gigantic task in a methodical manner and to ensure that the translations of *Qānūn al-Mas'ūdī*, *Kitab al-Ṣaydanah* and *Kitāb-ul-Hind* would be of a high quality

Dr Sibte Nabi Naqvi commented that the objectives of the Millenary can be best served by introducing the achievements of our forefathers and filling in the painful vacuum in the history of science This bridging of the gap can be done by translating those books, which were written by our illustrious ancestors during the Middle Ages and by relating them to modern science, so that scholars of the arts and sciences may see and take advantage of the clear-cut link between past discoveries and modern research and development The link-up can be achieved if detailed footnotes, prefaces and introductions are appended to the

translations Hence the translation work should be conducted bearing these considerations in mind

Dr Moinul Haq suggested that we should also obtain the services of a Sanskrit scholar, so that whatever material is available in Sanskrit on the books of al-Biruni, may be translated He also observed that Hamdard National Foundation should organise an International Seminar and the papers presented there, be published in the form of a book

The work of translating the *Qānūn al-Mas'ūdī* and its publication should receive top priority

An English translation of Syed Hasan Barani's treatise on al-Biruni should also be published

If this is done, our contribution to the project will become substantial and useful

In this connection, Dr Ishtiaq Husain Qureshi proposed the name of Dr Dani, an eminent Sanskrit scholar

Dr Qureshi expressed the view that if the translation of *Qānūn al-Mas'ūdī* could not be completed by 1973, it could be continued for a longer period

Hakim Mohammed Said said that he had references on *Qānūn al-Mas'ūdī* in his library

Major Aftab Hasan suggested that microfilms of these references should be made available

Dr Manzoor Ahmed suggested that the translation of this book should be published, first in English and then in *Urdū*, under the auspices of Hamdard National Foundation

Hakim Mohammed Said said that the first task is to translate *Qan'ūn al-Mas'ūdī*

Dr Mazharul Haq suggested that for implementing such a gigantic task, incentive must be there because everybody already has his own commitments If the incentive is not there, then the work could not be accomplished

The House decided that translation work of *Qānūn al-Masudi* would be undertaken in Karachi For this purpose, the services of astronomers, mathematicians, scientists and scholars of Arabic, Persian and Sanskrit would be obtained

A Working Committee of the following members was formed:

1 Dr Sibte Nabi Naqvi (Convener)

2 Mr. Muhammad Sa'ud

3 Hakim Mohammed Said

Hakim Mohammed Said informed the House that Dr Raziuddin Siddiqui, Vice-Chancellor, University of Islamabad, had kindly agreed to go through the translation The House appreciated the kind offer of Dr Raziuddin Siddiqui

Regarding the date of the Millenary, Dr Mahmud Husain suggested that it should be held in the second half of November, 1973 The House agreed unanimously The House also decided that the name of **al-Biruni**, although spelt differently at different times, should henceforth be officially spelt as **al-Biruni**

Dr Nazir Ahmed, former Chairman of the Pakistan Atomic Energy Commission, who could not attend the meeting, had sent the following suggestions to be included in the proceedings

"Before any work of al-Bīrūnī is translated either in English or *Urdu*, it must be properly edited This may sound rather an easy thing to do, but in the case of old manuscripts it is actually not an easy matter I remember that when I was working on my Ph D thesis in Physics in Cambridge, the late Prof Browne used to give an old Arabic manuscript to one of the research students, who were doing research for their Ph D degree in Arabic Their task was to edit the book, which consisted in comparing of various manuscripts, removing the errors, giving proper annotations and references, etc The successful completion of this work entitled a research worker to the Ph D degree

"I, therefore, suggest that in the first place an attempt should be made by writing to the various large libraries such as the Bodleian Library at Oxford, University of Cambridge Library, the Bibliotheque Nationale in Paris, the British Museum, etc to find out where these manuscripts are available, to get their photostat copies, to compare them, and finally to prepare a properly corrected and annotated copy, if this work has not already been done by any of the Western or Eastern scholars

"My next suggestion is that, so far as the translation is concerned, we should concentrate only on the *Kitāb-ul-Hind* and leave out *Qānūn al-Mas'ūdi* The former book will be of direct interest to us Apart from it, the translation of *Qan'ūn al-Masudi* will be a very difficult task I know that a copy of this book was available in Aligarh, and the late Dr Sir Ziauddin, who was an eminent mathematician, was trying to translate it, but did not make much progress I

have also heard that, unfortunately, the manuscript was lost In any case, apart from its historical interest, the book will have little scientific value as in the meantime the science of mathematics has made tremendous advances

"So far as the edition and translation of *Kitāb-ul-Hind* is concerned, I suggest that the following two scholars should be associated with this project —

1 Maulana Abdul Aziz Memon

2 Dr S M Yusuf, Professor of Arabic in the Karachi University

"Maulana Abdul Aziz Memon is well-known for his erudition in Arabic language, and Dr S M Yusuf is presently one of our great scholars in Arabic It would indeed be a pity to leave them out from such an important work

"I also suggest that, in view of the eminence of Maulana Abdul Aziz Memon, he should be made the Chairman of this Committee "

Mr Khalid Latif observed that as the personality, the scientific observations and the works of al-Biruni have received very limited appreciation and recognition, we must therefore use the mass-communication media in order to make this splendid personality known to the general public and specially to the younger generation The mass-communication media are given below —

1 Newspapers, periodicals and journals, etc ,

2 Radio,

3 Television

With a vote of thanks to the Chair, the meeting came to an end

PROCEEDINGS OF THE MEETING ON AL-BĪRŪNĪ

Held at Beirut on 13th July, 1972

In order to hold an International Congress to Celebrate the Millenary of al-Biruni, in Pakistan, during 1973, *a meeting of the Advisory Council was called on* 13*th July* 1972, *at* 7 30 *p m at the residence of Professor Syed Husain Jafri, under his Chairmanship The following distinguished scholars participated*

1 Professor Charles Malik,
Distinguished Professor of Philosophy,
Department of Philosophy,
American University of Beirut
Beirut,

2 Professor Edward Kennedy,
Department of Mathematics,
American University of Beirut,
Beirut

3 Professor Nicola Ziadeh,
Department of History,
American University of Beirut,
Beirut

4 Professor Mahmud Zayid,
Department of History,
American University of Beirut,
Beirut

5 Professor Majid Fakhry,
Department of Philosophy,
American University of Beirut,
Beirut

6 Professor Wilfred Cantwell Smith,
Center of World Religions,
Harvard University,
Cambridge, Massachusetts, USA

7 Professor Mahmud Gul,
Department of Arabıc,
American University of Beirut,
Beirut

8 Professor Ihsan Abbas,
Department of Arabıc,
American University of Beirut,
Beirut

9 Dr Salahuddin al-Munajjıd,
P O Box No 5264,
Beirut,

10 Dr Mrs Dunya Munajjıd,
P O Box 5264
Beirut

11 Mr George Salıba,
Department of Near Eastern Studies,
University of California,
Berkeley,
San Francisco, California, USA

12 Dr Umer Farrukh,
The Arabic University,
Beirut

13 Dr Hasan Saab,
The Lebanon University,
Beirut

14 Dr Fu'ad Sarruf,
Jallad Shabshab Building,
Rue de Caire Ras Beirut,
Beirut

15 Dr Abid Husain,
Jamia Millıyyah Islamıyyah,
Jamıya Nagar,
Okhla, Delhi

16 Dr Hasan Askari,
Reader, Sociology,
Osmania University,
Hyderabad, (India)

17 Professor Syed Husain Jafri (Convener),
Aga Khan Visiting Professor,
Center of Islamic Studies,
Fisk Hall,
American University of Beirut,
Beirut

18 Dr Samir K Thabet
Prof. of Chemistry,
American University of Beirut,
Beirut

19 Hakim Mohammed Said,
President,
Hamdard National Foundation,
Karachi

In his inaugural speech, Hakim Mohammed Said, President, Hamdard National Foundation, Pakistan, briefly expressed his views on the personality of al-Bīrūnī and informed the House about the steps taken so far for holding an International Congress He also cast some light on the contacts made and relations established so far with the intellectuals in Americas and Europe The House requested that the scholars, who were present in the Advisory Council Meeting, should co-operate and support the noble cause, so that the Congress should prove effective and useful The meeting lasted up to 11 30 p m

The views expressed in the meeting of the Advisory Committee are briefly given below

DR FU'AD SARRUF

Jallad Shabshab Building, Rue de Caire Ras Beirut, Beirut

I have to express my utmost pleasure on this summit of scientists and to say that the distinguished personality of al-Bīrūnī demands a fitting celebration of his Millenary and a rediscovery of his works I whole-heartedly support the suggestion that UNESCO (United Nations Educational, Scientific & Cultural Organization) be moved to actively participate in the celebrations While at the UNESCO Headquarters in Paris, I had the opportunity to exchange views with Hakim Mohammed Said, who was also on tour there Again I stress that we must plan a suitable programme which I may present in the next session of the

Executive Committee of UNESCO, duly supported by the Pakistan delegation The proposal may aim at two points

(a) UNESCO should arrange at its Headquarters the Millenary celebrations of al-Bīrūnī in the same way it had celebrated Lincoln's and Lenin's Days

(b) UNESCO should request its member-nations to celebrate the Millenary of al-Bīrūnī in their own countries

It should be better if the proposal is properly considered and elaborated in this session of the Advisory Committee

PROFESSOR MAHMUD ZAYID

Department of History, American University of Beirut

It is a strange coincidence that when I received an invitation to participate in this Advisory Committee Meeting, I was writing an article on al-Bīrūnī It is not possible to do full justice to al-Bīrūnī's personality and achievements In the World of Islam personalities who rise to such rare heights like al-Bīrūnī, are quite rare Personalities like him, born, living and dying within the pale of Islam are first of all Muslims It is a deeply regrettable fact that their achievements—literary, artistic or scientific, have been overlooked or ascribed to some one else or buried in oblivion In spite of this, the present realistic trends and extraordinary awakening in the World of Islam have struggled hard to revive and perpetuate the teachings and works of the old Masters The celebration of the Millenary of al-Bīrūnī is in line with this flowering of the Islamic spirit, and an effort to recall and promote the works of a Muslim scientist

PROFESSOR MAHMUD GUL

Department of Arabic, American University of Beirut

Intellectuals of the world and men of letters are exploring the personality of al-Bīrūnī and his scientific contributions in order to bring to the spotlight the versatility of this great man We being patronizers of science and arts, have a natural inclination towards them In our efforts to lift veils of obscurity that hide the great Muslim pathfinders and pioneers, we must concentrate on the truth We must not confine our research to the Islamic world by claiming that al-Bīrūnī is a Muslim scientist only Al-Bīrūnī belongs to all ages and all climes Knowledge is not the heritage or property of a single country or individual It knows no frontiers It belongs to all Therefore al-Bīrūnī's genius and achievements are universal and must be projected as such

DR UMER FARRUKH

The Arabic University, Beirut

I have been a scholar, engaged in studying the works of al-Bīrūnī all my

life My long experience in this field proves that al-Bīrūnī's personality and achievements are overpowering and admitting of vast research Scholars in the true sense are not biased Dedicated to the arts and sciences, they labour to present the old Masters in truth, justice and clarity It is my opinion that instead of confining al-Bīrūnī to the World of Islam only, we must declare and establish his position as a universal scientist

DR CHARLES MALIK

Distinguished Professor of Philosophy, American University of Beirut

In my opinion, Hamdard National Foundation, Pakistan, and Hakim Mohammed Said himself, deserve congratulations as they have accepted the responsibility of a very noble and magnificent work Indeed, al-Bīrūnī is a great personality and his genius and achievements demand that his memory is rewarded suitably I mean that all intellectuals and men of wisdom should jointly and with love and devotion, explore his contributions which led science and art on the road of progress and prosperity Keeping his pioneering spirit in view we have to think deeply on how we can make best use of his contributions It is in my knowledge that a number of persons are working on al-Bīrūnī, and now, because of the Millenary celebrations, many more are entering in the field We are sure that the Millenary celebrations of al-Bīrūnī will ultimately result in the completion of some substantial scientific and literary contributions To achieve this goal, full support and co-operation from all over the world is essential

The stock of the literary and scientific heritage, left by al-Bīrūnī is so overwhelming that it requires a well-organized institute to work on it judiciously This is a necessity Such an institute will need at least fifty scholars working together for two hundred years Only then we will be able to accomplish the task and establish truth I will like to emphasize on Hakim Mohammed Said that if this work is done and its basic aims achieved, then we will have scaled the pinnacles of the world of science

I hope and pray for the success of the Millenary celebrations and appeal to men of wisdom and science to co-operate in this noble cause

DR EDWARD KENNEDY

Department of Mathematics, American University of Beirut

I, as a scholar of al-Bīrūnī, duly acknowledge that this great learned intellectual deserves full respect and honour from us His literary and scientific legacy to the whole world, is a valuable treasure to be drawn upon and used even at the present day I endorse the suggestion that whatever contributions of

al-Bīrūnī we may get through various sources, be edited and published Investigation and research must be recorded and his works and writings, edited and published for general use For instance, a scholar of Lahore (West Pakistan) Professor F D Qureshi translated a book of al-Bīrūnī, Ghurrah al-Zījāt from Arabic to English I have had the opportunity to see this work through the courtesy of Prof M M Abdullah of University Oriental College, Lahore Thus part of an important work has been accomplished in Pakistan, but its printing remains which deserves our immediate attention and collaboration

PROFESSOR WILFRED CANTWELL SMITH

Centre of World Religions, Harvard University, Cambridge, (U S A)

In my opinion to tell you the truth this is not my field of work Therefore, I am unable to make any concrete, pertinent suggestions I was invited here so that in the light of experience gained through arrangements and organizations of international discussions and seminars, I may give some advice I am of opinion that, during the Millenary celebrations of al-Bīrūnī, international principles of such functions and celebrations be kept in mind However, I will not hesitate to give my suggestions whenever need arises in this respect

DR SAMIR K THABET

Prof of Chemistry, American University of Beirut

In view of the great personality of al-Bīrūnī, I am of opinion that his Millenary be celebrated not only in Pakistan but throughout the world However, it should be kept in mind that the celebrations, in all respects be dignified and scientific Al-Bīrūnī's works should explored and studied so thoroughly that all his scientific and literary contributions stand fully discovered by the world of today so that the natural link between past discoveries and modern developments is established I am sure that the scholars of Beirut, in particular, and the scholars of the world, in general, will whole-heartedly give their support and co-operate in this noble task Our efforts to spotlight the achievements of the old Masters and make a permanent place for them in the history of science and medicine will thereby be realised

Dr NICOLA ZIADEH

Department of History, American University of Beirut

Hamdard National Foundation is playing a very effective role in reviving suitably the life, works and achievements of the old Masters In 1970, the Millenary celebrations of Ibn al-Haitham were sponsored by it In 1973, the

Millenary celebrations of al-Bīrūnī, the great Muslim scholar, scientist and geographer, in fact one of the greatest geniuses of all time will be held To make this Millenary purposeful and successful, the co-operation of scholars and intellectuals is necessary I, on my part will contribute a paper on "Al-Bīrūni as a Historian"

To create regional interest and participation it is important that Regional Committees be formed as soon as possible e g (1) Al-Bīrūnī Committee for Beirut (for the Middle East), (2) Al-Bīrūnī Committee for New York (for the U S A), (3) Al-Bīrūnī Committee for Teheran (for Iran—Dr Seyyed Hossein Nasr may be kindly approached to convene the Committee), (4) Al-Bīrūnī Committee for New Delhi (for India—Hakim Abdul Hameed may be approached to convene the Committee) In my opinion such Committees will be very useful for co-ordination and accelerating the work, because they will be in constant contact with the scholars of their region I also suggest that these Committees be given powers to select the Delegations to participate in the Millenary celebrations in 1973

For the Beirut Committee, the following names have been suggested and agreed upon

(1) Dr Michael Alard, Director of Islamic Studies, St Joseph's University

(2) Mr Stephen Wild, Director, German Oriental Institute

(3) Dr Nicola Ziadeh, Dept of History, American University of Beirut

(4) Professor Syed Hussain Jafri, Aga Khan Visiting Professor, Center of Islamic Studies, Fisk Hall, American University of Beirut

(5) The fifth name will be suggested by Dr Ziadeh and Professor Jafri and will be included in the Committee

HAKIM MOHAMMED SAID

President, Hamdard National Foundation, Pakistan

Al-Bīrūnī's is a many-splendoured personality To concentrate only on his scientific achievements or only on his literary achievements would not reveal his genius wholly and truly We should think of new aspects in the works and writings of al-Bīrūnī and set new dimensions for the study of his thoughts

Hakim Mohammed Said and Professor Jafri suggested the following

(1) Al-Bīrūnī as an Anthropologist, (2) Cultural Patterns as expounded by al-Bīrūnī, (3) Comparison between Ibn al-Bayṭār and al-Bīrūnī, (4) Al-Bīrūnī's

scientific language and terms, (5) Methodology of al-Bīrūnī, (6) Folk Literature of al-Bīrūnī

There are so many other aspects for our consideration, and scholars should be approached to write articles on them.

At the end, Professor Husain Jafri, on behalf of Hakim Mohammed Said, the Hamdard National Foundation and on his own behalf, thanked the distinguished personalities for their kind participation, the interest, enthusiastic support and the promise of whole-hearted co-operation to make the International Congress purposeful and successful He assured them that the Congress would serve to show the inescapable connection between the traditions of the past with the advance of modern science If we wish to trace how the advance of science has altered the whole frame of human thought, it would be necessary to go far back to the old Masters, like al-Bīrūnī, without whose theories the phenomenal progress of science would not have been possible

With a vote of thanks to the Chair, the meeting terminated

NEW YORK COMMITTEE

1 Dr Syed Barakat Ahmad,
18th J York River House,
New York

2 Professor Chandler McC Brooks,
450, Clarkson Avenue,
Brooklyn,
New York 11203,
U S A

3 Professor Ainslie T Embree,
Associate Dean,
School of International Affairs,
Columbia University,
New York

4 Dr Parviz Morewedge,
New York University,
50, Washington Square,
New York

5 Professor F E Peters,
Deptt of Near East Languages &
Literatures,
New York University,
New York

PROGRAMME

KARACHI

Monday, November 26, 1973

INAUGURAL SESSION

Congress Hall,
Beach Luxury Hotel,
6 p m

Recitation from the Holy Qur'an

WELCOME

Hakim Mohammed Said

ADDRESS

Mr Qudratullah Shahab,
Secretary, Ministry of Education,
Government of Pakistan

MESSAGE

Director-General,
United Nations Educational, Scientific and
Cultural Organisation

GREETINGS

Participating Countries

INAUGURAL ADDRESS

H E Begum Ra'ana Liaquat Ali Khan,
Governor of Sind

Tuesday, November 27

Plenary Session No 1,
Floor 22 (Habib Bank Plaza)

PRESIDENT

Professor Yu V Gankovsky

SPEAKER.

Professor Lawrence Zıring

AL-BIRUNI ONE THOUSAND YEARS LATER

Break

HISTORY SESSION

10 30 a m to 1 p m
Floor 22, Habıb Bank Plaza

CHAIRMAN

Dr I H Qureshı

SECRETARY

Dr Rıazul Islam

RECORDER

Dr M H Sıddıquı

**Nuzhat an-nufūs wal afkār fi Khawāṣṣ al-mawālıd athalāth al-ma'ādın wanna-bāt wal-ahdjār*

PROFESSOR J C BURGEL

*Study of al-Bīrūnī's Lıfe & Works ın the U S S R

PROFESSOR YU V GANKOVSKY

**Deux Fıgures de Savants et d'Humanıstes Bīrūnī et Albert Le Grand*

PROFESSOR LOUIS GARDET

*Abū Raıḥān Muḥammad ıbn Ahmad al-Bīrūnī A Restless Genıus ın Search of Knowledge

MR G ALLANA

*Al-Bīrūnī's Indıa

PROFESSOR A M A R FATIMI

HISTORY SESSION

2 p m to 5 p m
Floor 22, Habıb Bank Plaza

CHAIRMAN

Dr Mahmud Husaın

SECRETARY.

Dr Riazul Islam

RECORDER

Dr M H Siddiqui

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*Some aspects of al-Bīrūnī's Education

PROFESSOR MAHMUD ZAYID

*The Political Situation of Iran at al-Bīrūnī's Epoch

PROFESSOR BERTOLD SPULER

*The Dispute over the Birthplace of al-Bīrūnī

DR FARMAN FATEHPURI

*Our Regional Languages at the Time of al-Bīrūnī

MR MUNIR A FARUQI

SHAM-I-HAMDARD LECTURE

6 p m
University of Karachi
Arts Auditorium

GUEST SPEAKER

H E Dr Seyyed Hossein Nasr

PRESIDENT

Dr Mahmud Husain

INTRODUCTION

Mr A K Brohi

Wednesday, November 28

Plenary Session No 2
9 a m to 10 a m
Floor 22, Habib Bank Plaza

PRESIDENT

H E Dr Seyyed Hossein Nasr

SPEAKER

Professor F E Peters

SCIENCE, HISTORY AND RELIGION

SOME REFLECTIONS ON THE INDIA OF ABŪ RAIHĀN AL-BĪRŪNĪ

Break

PHILOSOPHY SESSION

10 30 a m to 1 p m
Floor 22, Habib Bank Plaza

CHAIRMAN

Mr A K Brohi

SECRETARY

Dr Manzoor Ahmad

RECORDER

Dr K A Kadir

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*Al-Bīrūnī and the Phenomenology of Religion

PROFESSOR ISMAIL R al-FARUQI

*Al-Bīrūnī and Human Values of the Eastern Renaissance

DR G R SABRI-TABRIZI

*Al-Bīrūnī's Study of Non-Islamic Religions

PROFESSOR W MONTGOMERY WATT

*The attitude of al-Bīrūnī towards Science & Education

DR HISHAM NASHABI

*Al-Bīrūnī's Methodology and its Sources

MR OBAIDULLAH QUDSI

Thursday, November 29

Plenary Session No 3
9 a.m to 10 a m
Floor 22, Habib Bank Plaza

PRESIDENT

Professor Aydın Sayılı

SPEAKER

Professor Roger Arnaldez

CONCEPTION ET PRATIQUE DE LA

SCIENCE CHEZ BĪRŪNĪ ET IBN SĪNĀ

SCIENCE SESSION

10 30 a m to 1 p m
Floor 22, Habib Bank Plaza

CHAIRMAN

Prof Dr Salimuzzaman Siddiqui

SECRETARY

Mr A H Chotani

RECORDER

Dr Fazle Karim

**The Kitāb al-Jamāhir fi Ma'arifah al-Jawāhir* A Chemical and Mineralogical Study

PROFESSOR DR GEORGES ANAWATI

*Notes of Al-Bīrunī's Views of al-Rāzī's Works

DR SALEH HAMARNEH

*Notes on *Risālah L'il Bīrūnī fi Fihrist Kutub al-Rāzī*

PROF MEHDI MOHAGEGH

*Some Glimpses of al-Bīrūnī as a Geographer

PROFESSOR NAFIS AHMAD

*The *Kitāb al-Ṣaydanah* Structure & Approach

Mr KAMAL M HABIB

*Al-Bīrūnī's Contribution to Biological Studies and Concepts in his Book *Kitāb al-Jamāhir fi Ma'arifah al-Jawāhir*

PROFESSOR DR M A H QADRI

*The Evolution of Cosmology in the Hands of Muslims up to the Time of al-Bīrūnī

PROF SYED SIBTE NABI NAQVI

SCIENCE SESSION
2 p m to 5 p m
Floor 22, Habib Bank Plaza

CHAIRMAN

Dr M Shafqat Husain Siddiqui

SECRETARY

Mr A H Chotani

RECORDER

Dr Fazle Karim

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*Al-Bīrūnī and his Religious Tolerance towards Scientific Problems

PROF M DANECHPAZUH

*The Trigonometry of al-Bīrūnī

DR AHMED SAIDAN

*Al-Bīrūnī and the History of Science

PROFESSOR AYDIN SAYILI

**Le Message Scientifique d'al-Bīrūnī et sa Portee actuelle dans les pays Musulmans*

DR MOHAMED SOUISSI

*Al-Bīrūnī and his *Kitāb al-Jamāhir fi-Ma'arifah al-Jawāhir*

PROFESSOR S H H NADVI

*A Newly Discovered Book of al-Bīrūnī—*Ghurrah-al-Zījāt*—and al-Bīrūnī's Measurements of Earth's Dimensions

MR SAIYID SAMAD HUSAIN RIZVI

PESHAWAR

Venue
University of Peshawar

Saturday, December 1, 1973

INAUGURAL SESSION

UNIVERSITY CONVOCATION HALL
10 a m

Recitation from the Holy Qur an

WELCOME

Professor Abdul Ali Khan,
Vice-Chancellor

INTRODUCTION
Hakim Mohammed Said

INAUGURAL ADDRESS

H E Mr Mohammad Aslam Khan Khattak
Governor of N W F P

*The Stations of al-Bīrūnī on the Journey from Ghaznah to Peshawar

DR A D H BIVAR

Vote of Thanks

Dr A Munawar Khan

SECOND SESSION

3 p m to 5 15 p m
Science Hall

CHAIRMAN

Dr Munawar Khan

SECRETARY

Dr Qazi Mujib-ur Rahman

RECORDER

Miss Lal Baha

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*Al-Bīrūnī's View of the Indian Society in his Book on India

PROFESSOR IBRAHIM OLGUN

**Al-Bīrūni Wal-lughatul-'Arabiah*

DR SALAH AL-MUNAJJID

*Al-Bīrūnī as an Astrologer

DR K B NASEEM

*Al-Bīrūnī as a Mathematician

DR S N YOUSUF

*Al-Bīrūnī's Account of Dhu al-Qurnayn

DR MIR WALI KHAN

Monday, December 3

FIRST SESSION

9 30 a m to 12 p m
Science Hall

CHAIRMAN
Professor S M Moghni

SECRETARY
Dr K B Naseem

RECORDER
Mr Zafar Afaq Ansari

---

*Al-Bīrūnī as an Astronomer

PROFESSOR AKBAR DANACERESHT

*Al-Bīrūnī's Contribution to Geography

DR MUHAMMAD ISRARUDDIN

*An Interpretation of al-Bīrūnī's account of the Hindu Shāhiyahs of Kābul

MR HUSSAIN KHAN

*Al-Bīrūnī as a Litterateur

DR QAZI MUJIB-UR-RAHMAN

SECOND SESSION

3 p m to 5 15 p m
Science Hall

CHAIRMAN
Dr S Marghoob Ali

SECRETARY
Dr M Israruddin

RECORDER
Dr Muhammad Aslam

*Al-Bīrūnī and Indian Culture

MR. KHATIR GHAZNAVI

*Al-Bīrūnī's Contribution to Natural Sciences

PROFESSOR A R NOWSHERVI

ISLAMABAD

Venue

University of Islamabad

Tuesday, December 4

INAUGURAL SESSION

Auditorium, Planning Commission
9 30 a m to 10 30 a m

In presence of
Mr Fazal Elahi Chaudhry,
President,
Islamic Republic of Pakistan

Recitation from the Holy Qur'an

WELCOME

Dr (Miss) Kaniz F Yousuf,
Vice-Chancellor,
University of Islamabad

INAUGURAL ADDRESS

Mr Fazal Elahi Chaudhry,
President,
Islamic Republic of Pakistan

SECOND SESSION

10 30 a m to 12 30 p m
University of Islamabad

PRESIDENT

H E Dr Manoutchehr Zelli,
Ambassador of Iran in Pakistan

*Al-Bīrūnī and Mysticism

DR BRUCE B LAWRENCE

*Early Iranian Knowledge of Pakistan, with Special Reference to Bīrūnī's Works

DR ALI AKBAR JAFAREY

*Al-Bīrūnī's Methodology in India

MR MOHAMMAD ASLAM

*Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī—Life and Works

PROFESSOR F A SHAMSI

*A Brief Review of Bīrūnī's Works

MR MOHAMMAD HOSSEIN TASBIHI

SHAM-I-HAMDARD LECTURE

3 30 p m

Hotel Rawalpindi Intercontinental

GUEST SPEAKER

Professor W Montgomery Watt

PRESIDENT

Dr Z A Hashmi

INTRODUCTION

Hakim Mohammed Said

Wednesday, December 5

9 30 a m to 12 30 p m
University of Islamabad

PRESIDENT

Professor Dr Georges Anawati

**Daw-e-al-Bīrūnī fi-Tahdīd Muba'-al Mubda' al-Sabab al-Kāfi*

PROFESSOR M Y OREIBI

*A Re-evaluation of al-Bīrūnī's Indica

PROFESSOR A H DANI

*Indian Society as described by al-Bīrūnī

PROFESSOR SH ABDUR RASHID

*Life and Works of al-Bīrūnī

PROFESSOR GHULAM RABBANI AZIZ

*Comments on *Tahdīd Nīhayatul Amākin*

Mr INAMULLAH JAN

*Al-Bīrūnī and Ṣūfism

MR AGHA HAMDANI

*Al-Bīrūnī and the Holy *Qur'an*

DR M S H MASUMI

*Glimpses of Indian Culture during the Age of al-Bīrūnī

MR MOHAMMAD TUFAIL

LAHORE

Thursday, December 6

SHAM-I-HAMDARD LECTURE

3 30 p m
Hotel Lahore Intercontinental

GUEST SPEAKER
Professor Bertold Spuler

PRESIDENT
Dr S A Rahman

INTRODUCTION
Hakim Mohammed Said

Friday, December 7

INAUGURAL SESSION

University of Panjab, New Campus
3 p m to 5 p m

Recitation from the Holy Qur'ān

WELCOME

Professor Dr Mohammad Ajmal,
Vice-Chancellor

INAUGURAL ADDRESS

Chancellor of the University and Governor of the Punjab

VOTE OF THANKS

Hakim Mohammed Said

Saturday, December 8

HISTORY SESSION

9 00 a m to 11 30 a m

NIPA Hall

CHAIRMAN

Professor Sheikh Abdur Rashid

SECRETARY

Professor Dr Muhammad Aslam

RECORDER

Mr S Ali Abbas

---

*Encounter of Cultures in the Work of al-Bīrūnī

PROFESSOR JUSSI ARO

*Travels and Times of al-Bīrūnī

PROF MUHAMMAD BAQIR

*Lahore and al-Bīrūnī

MR WALIULLAH KHAN

*Al-Bīrūnī's Political Role & Philosophy

PROFESSOR ABDUS SALAM KHURSHID

*The Modern al-Bīrūnī

DR M ASLAM QURESHI

*Al-Bīrūnī and Hindu Culture and Civilization

PROFESSOR M USMAN

HISTORY SESSION
3 00 p m to 5 00 p m
NIPA Hall

CHAIRMAN
Professor Hameed Ahmad Khan

SECRETARY
Professor Dr Ebadet Brelvi

RECORDER
Dr M Aslam Qureshi

---

*Al-Bīrūnī *Muālifatul Maktoota*

PROFESSOR ABDUL QADIR KARAHAN

*A Bibliography of Rhazes by al-Bīrūnī

DR M NADJMABADI

*Al-Bīrūnī and Geography

PROFESSOR MUHAMMAD ASLAM

*Al-Bīrūnī as a Modern Thinker

SYED ALI ABBAS

*The Method of Research in the Days of al-Bīrūnī

MR M WARRIS MIR

Monday, December 10

SCIENCE SESSION

9 a m to 12 p m

NIPA Hall

CHAIRMAN

Dr M A Ajmal

SECRETARY

Dr Ghulam Sadiq

RECORDER

Mr Laeeq Ahmad Khan

---

*A History of Precious Stones in Islam with Special Reference to al-Bīrūnī's *Kitāb al-Jamāhir*

DR SAMI HAMARNEH

*Al-Bīrūnī and Ibn al-Haitham

A Comparative Study of Scientific Method

MR ANTON HEINEN

*Source Books of *Kitāb al-Ṣaydanah*

DR RANA EHSAN ELAHIE

*Tri-Section of a Given Angle

PROFESSOR F D QURESHI

*On the First Redaction of the *al-Tafhim* of al-Bīrūnī

PROFESSOR ABDULGANI MIRZOEV

*Al-Bīrūnī as a Philosopher

DR BURHAN AHMAD FARUQI

*Al-Bīrūnī as a Cultural Historian

DR NASEER AHMAD NASIR

SOCIAL ACTIVITIES

KARACHI

Monday, November 26, 1973

1 00 p m	Get-Together Lunch at Beach Luxury Hotel (By invitation)
3 00 p m	Visit to Quaid-e-Azam Memorial
6 00 p m	Inauguration at Beach Luxury Hotel (By invitation)
7 00 p m	Reception by Hamdard National Foundation, Pakistan, on Beach Luxury Hotel lawns (By invitation)
9 00 p m	Film show "Pakistan's Story" at Beach Luxury Hotel

Tuesday, November 27, 1973

4 30 p m	Reception by the Vice-Chancellor, University of Karachi at University Club (By invitation)
6 00 p m	Sham-i-Hamdard Lecture at University of Karachi Arts Auditorium

Wednesday, November 28, 1973

4 00 p m	Garden Tea Party by H E Begum Ra'ana Liaquat Ali Khan, Governor of Sind, at Governor's House (By invitation)

Thursday, November 29, 1973

7 30 p m	Dinner by Mr & Mrs A K Brohi in honour of H E Dr Seyyed Hossein Nasr and Delegates at 76, Muslimabad, Karachi, followed by Musical Soiree

Friday, November 30, 1973

8 30 a m	Visit to Hamdard Centre
9 30 a m	A tour of the City of Karachi

PESHAWAR

Saturday, December 1, 1973

1 00 p m.	. Lunch by the Vice-Chancellor, University of Peshawar (By invitation)
7 30 p m	Dinner by H E Mr Mohammad Aslam Khan Khattak, Governor of N W F P and Chancellor, University of Peshawar, followed by Khattak dance (By invitation)

Sunday, December 2, 1973

9 00 a m	Visit to Khyber Pass
1 00 p m	Lunch by the Political Agent, Khyber Agency (By invitation)

Monday, December 3, 1973

1 00 p m	Lunch by Sarhad Chamber of Commerce (By invitation)
8 00 p m	Pashtoon Dinner by Park Hotel Management (By invitation)

ISLAMABAD

Tuesday, December 4, 1973

3 30 p m	Sham-i-Hamdard Lecture at Hotel Rawalpindi Intercontinental
8 00 p m	Dinner by Mr Abdul Hafeez Pirzada, Federal Minister for Education at Hotel Rawalpindi Intercontinental (By invitation)

Wednesday, December 5, 1973

1 00 p m	Lunch by the Vice-Chancellor, University of Islamabad at Chand Restaurant (By invitation)
2 30 p m to 6 00 p m	Visit to Taxila, Margala Pass, Nicholson Tower, Moghul Road, Shahjahan's Inscription, Jandiala (Zoroastrian Temple), Sirkap (Greek City site), Tea at Taxila Museum, Visit to Taxila Museum

LAHORE

Thursday, December 6, 1973

1 00 p m	Lunch at Shalimar Room
2 30 p m	Unveiling ceremony of AL-BIRUNI ROAD plate (Lahore Corporation) at Senate Hall (By invitation)
3 30 p m	Sham-i-Hamdard Lecture at Hotel Intercontinental
7 30 p m	Dinner by Mian Ameerud-Din at Hotel Intercontinental (By invitation)

Friday, December 7, 1973

8 30 a m	Visit to the tomb of Allama Iqbal & Badshahi Mosque
10 20 a m	Coffee at the residence of Mian M Aslam
11-12 noon	Visit to the Old Fort, Jum'a prayers at Badshahi Mosque (Lunch at Shalimar Room)
3 00 p m to 5 00 p m	Inaugural Session at Panjab University, New Campus
7 30 p m	Dinner by the Chancellor (By invitation)

Saturday, December 8, 1973

1 00 p m	Visit to the Packages Ltd
1 00 p m	Lunch by Syed Babar Ali Shah (By invitation)
7 30 p m	Dinner by Hakim Nayyar Wasti (By invitation)

Sunday, December 9, 1973

8 00 a m	Service at Cathedral
9 30 a m	Visit to the tomb of Jehangir & Noor Jehan
10 00 a m	Coffee/Tea by Mian Aslam Ranjha
12 noon	Visit to the Shalimar Garden
1 00 p.m	Lunch by Chaudhry Nazir Ahmad (By invitation)
3 40 p m	Visit to the Engineering University At-home by the Engineering University (By invitation)
7 30 p m	Dinner by the National Bank of Pakistan (By invitation)

Monday, December 10, 1973

1 00 p m	Lunch by Lahore Chamber of Commerce & Industry at Gymkhana Club Opp International Hotel (By invitation)
5 30 p m	Visit to the Panjab University Library (By invitation)

NATIONAL PARTICIPANTS

1 Professor Sh Abdur Rashid,
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2 Syed Ali Abbas,
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3 Dr S Marghoob Ali,
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5 Mr Zafar Afaq Ansari,
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6 Dr Muhammad Aslam,
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8 Professor Ghulam Rabbani Aziz,
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9 Miss Lal Baha,
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10. Professor Dr Muhammad Baqir,
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11 Professor Dr Ebadet Brelvi,
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12 Mr A K Brohi,
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13 Mr A H Chotani,
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14 Professor A H Dani,
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20 Professor A M A R Fatimi,
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30 Dr Mir Wali Khan,
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MESSAGES

AFGHANISTAN

H E Dr N Pazhwak,
Minister of Education

IT is a source of great pleasure to me that the meeting to commemorate the anniversary of the celebrated Afghan scholar of the 4th and 5th centuries of the Hegira, namely Allama Abu Reyhan Mohammad Ibn Ahmad Berouni is being held in the friendly country of Pakistan That the estimable representative of Pakistan has attended the El-Berouni festival in Kabul is yet another example of the interest displayed by our friend for which we must express our appreciation and gratitude We would like to recall that at the conclusion of the millenium celebration of the birth of that great personality in Kabul it was stressed that however much this great personality is talked about, only an infinitesimal portion of the debt owed to him will be repaid by the scientific and cultural circles of the world, because Abu Reyhan Berouni took up the task of expanding his knowledge at a time when the possibilities of probing into the dark nooks and corners of science were not only non-existent but also extremely difficult to create That is why I, on behalf of myself and the educationists in Afghanistan hail with appreciation and admiration the Abu Reyhan Berouni Congress in Karachi city and await with deep enthusiasm its results for creating a better understanding of this peerless Afghan scholar

It is a fact that such rare features emerging in history serve as mirrors of the entire panorama of their era Such scholars of the Ghaznavid Period as Ferdousi, Abol-Fazal, Beihaqi and Unsary have, everyone of them, painted their time in one way or another Therefore, if we wish to look into the political, social and economic situation in Allama Abu Reyhan's time, or if we should desire to understand the legendary spirit of those days then it becomes incumbent upon us to study the history of

Beihaqi, the Shahnama and the Dewans of Farrukhi and Unsary But if it be desired to evaluate the standard of positive knowledge and scientific research then the works of Abu Reyhan must be resorted to

It must be stated that Abu Reyhan was a truly great person—morally and intellectually, and, therefore, it is proper that on UNESCO'S suggestion ceremonies to commemorate his birthday are being held in various places in the world, at which seekers of knowledge employ his works as beacons leading to perfection while the scholars revitalise their learning by reciting his name

The importance of such meetings lies in the fact that, as we know, the basic manner to understand the culture of the past as a spiritual bond between our present and future, is to probe into the works of those greats who laid its foundations in those ancient times One of these great persons is undoubtedly Abu Reyhan Berouni who spent the larger part of his precious life in the benign atmosphere of Ghazna, where he compiled his immortal works and left them to posterity

Research about his works is useful not only because it leads us to the fountainheads of culture, but also because it links that spiritual bond with the glories of the past

The Ministry of Education of the Republic of Afghanistan wishes greater success to UNESCO and all those countries which have taken the trouble of convening the Congress of this Afghan scholar, who now belongs to the entire scientific circles in the world

H E Dr Ali Ahmed Popal
Ambassador of Afghanistan in Pakistan

I wish you all the best for the success of the International Congress on Allama al-Biruni which is, no doubt, a great responsibility and task to be shouldered by you

ALBANIA

Dr Aleks Buda,
President of the Academy of Sciences,
People's Republic of Albania

THE Albanian scientific workers gladly received the news of the proceedings of the International Congress, being organized by you in commemoration of the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni

Al-Biruni is ranged among the most distinguished personalities of the science world, among those who have dedicated their gifts, knowledge and intense activity to the advance of science and the triumph of progressive scientific thought, the continuity of which, on a higher level, is our modern science

Now more than ever he enjoys the highest respect of all progressive scholars of the world as an encyclopedian, who countered the obscurantism and fought for friendship and equality among peoples Never should be forgotten and underestimated the great contribution which the peoples of East and Middle East have given to the common thesaurus of world civilization, a clear expression of which is al-Biruni, the scholar

That is why such a personality as al-Biruni is highly estimated by all men of science of the socialist Albania

Since we have just recently learnt through your letter of the proceedings of this Congress, you'll get this message after you have concluded Nevertheless, the Albanian scientific workers join you, the scientific workers of the fraternal people of Pakistan, in this remarkable celebration and send you on this occasion, their most heart-felt greetings and best wishes for the development and furtherance of science in your country

AUSTRALIA

H E Mr Kim E Beazley
Minister for Education,
Canberra

EVERY best wish for the success of your Congress

SIR RUTHERFORD ROBERTSON,
President,
Australian Academy of Science,
Canberra City

ON behalf of this Academy, I wish to thank you for the invitation to be present at the Congress and to express my regrets that it will not be possible for this Academy to be represented

On behalf of the Academy and its Council, I should like to convey our best wishes for a very successful occasion

DR A G MITCHELL
Vice-Chancellor,
Macquarie University

I shall not be able to be present but wish the Congress every success I am sure that the results that flow from it will be widely beneficial

DR R F WHELAN,
Vice-Chancellor,
The University of Western Australia

IT is fitting that the contributions of the peoples of Central Asia to the development of science should be recognized in this way I am most appreciative of the honour of having been invited to the Congress but regret that it will not be possible for me to attend

On behalf of the University of Western Australia, I send cordial greetings to the Hamdard National Foundation and extend our best wishes for the Congress which we hope will be an outstanding success

PROF ZELMAN COWEN,
Vice-Chancellor,
Univerity of Queensland
Brisbane

I send best wishes for the success of the occasion

BELGIUM

PROFESSOR DR A DEVREKER,
Rector,
University of Ghent

THE State University of Ghent wants to express its appreciation on the occasion of the celebration of the millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni with an International Congress

The personality of al-Biruni, one of the pioneers in the International Forum of distinguished scientists, is of such a value that he deserves all honour and respect

The State University of Ghent regards the celebration of the millenary of al-Biruni with an International Congress as a greatly significant contribution to the world of learning By highlighting the scholastic and scientific achievements of one of the old masters, it will go a great way to establish a natural link between past discoveries and present developments

DR M WELSCH
Rector,
Dr J Duchesne - Guillemin
Secretary of the Academic Council,
University of Liege

ABU RAYHAN AL-BERUNI, was not only a great scholar in many fields, he was the first who studied a foreign country in an objective fashion Although he never disavowed his Muslim convictions, his great book on India makes him the founder of the comparative study of civilizations

It is quite appropriate that Pakistan, the country in which he worked at this book, should celebrate his millenary

The University of Liege, Belgium, with its tradition of Oriental studies in the domains of Indology, Iranology and Islam, gladly associates itself with this celebration and sends its best wishes for the success of the Al-Biruni International Congress in Karachi

CANADA

DR R E BELL,
Principal,
McGill University,
Montreal

GREETINGS to the al-Biruni International Congress from McGill University on occasion of millenary of Abu Raihan On momentous occasion we send our sincere good wishes for a most successful congress (Telegram)

DR ROGER GAUDRY,
Rector,
University of Montreal

JE vous prie d'agreer l'expression de mes sinceres felicitations et de mes meilleurs voeux de succes

DR ROGER GUINDON, O M I,
Rector,
University of Ottawa

ALTHOUGH it will be totally impossible for me to be present at the International Congress to celebrate the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni, I want to express to you my thanks for having been informed of it and my best wishes for the success of your Congress

Dr Larkin Kerwin,
Rector,
University of Laval,
Quebec

L'UNIVERSITE LAVAL DE QUEBEC a appris avec joie que des fetes solennelles en meme temps qu'un Congres international marqueront, du 26 novembre au 12 decembre 1973 au Pakistan, le millenaire d' Abu Raihan Muhammad ibn Ahmad al-Biruni

A l'occasion de cet important evenement, le Recteur et les membres du Conseil de la plus ancienne universite de langue francaise en Amerique sont heureux de se joindre aux delegues des autres universites du monde et aux representants des grandes societes savantes pour rendre hommage a la memoire de cet evenement savant

Ils souhaitent que les deliberations de ces assises internationales destinees a mettre en lumiere l'heritage culturel et scientifique que nous ont legue les peuples de l'Asie centrale apportent au monde des fruits de sagesse, de justice et de paix

Dr J M Dewey
Dean of Academic Affairs,
University of Victoria, B C,

BEST wishes for your Congress

CHINA

Dr Kuo Mo-Jo,
President,
Academia Sinica
Peking

ON occasion of celebrating millenary of Abu Raihan Muhammad Ibn Ahmad al-Biruni with International Congress may we extend our warm congratulations and wish this congress success May friendship and friendly relations of cooperation between Sino-Pakistan scientists be further strengthened and developed (Telegram)

COLOMBIA

H E MR JUAN JACOBO MUNOZ,
Minister of Education,
Republic of Colombia

I hope this celebration will be highly fruitful and successful I will be with you in spirit Best wishes

EGYPT

H E MR ALY KHASHABA,
Ambassador of Egypt in Pakistan

H E Egyptian Education Minister conveys thanks kind invitation al-Biruni International Congress Regrets inability to attend Wishes Congress every success (Telegram)

FRANCE

H E MR HENRY BAYLE,
Ambassador of France in Pakistan

I warmly welcome the opening of the Al-Biruni International Congress under the auspices of Hamdard National Foundation, Pakistan

The interest of French science and culture for the outstanding contribution of al-Biruni to the intellectual and scientifical progress of mankind is clearly demonstrated by the presence, today, in Karachi of my two distinguished compatriots from the Sorbonne and Sainte Baume

May, I, for a moment, join my voice to so many learned voices, to express the sympathy of the Government of France

Is not al-Biruni an illustrious representative of those universal intellects of the Muslim-Arab world which have so much surprised and stimulated the European Middle Age's Christianity, before influencing the great thinkers and scholars of the XIVth and XVth century renaissance?

Like his contemporary and neighbour Ibn Sina, better known to the West by the name of Avicenna, al-Biruni offers, perhaps in an even more accurate way, a wide range of knowledge about the Greek, Persian, Arab and Hindu civilizations In his work comprizing 180 writings at present classified, al-Biruni tackles the whole of the known disciplines of his time - from Theology to Mathematics, from Geography to Astrology, from Cosmography to Natural Sciences - an invaluable legacy of Muslim thought to humanity

The honour fell by right to Pakistan to organize this International Congress on al-Biruni, to Pakistan as a Muslim State, and as a shelter for the exiled It was during this exile, mainly in Punjab, that al-Biruni studied Sanskrit, read the Indian texts questioned the Pandits, scanned the Indian soul from inside, so as to bequeath to us his master-work, the Kitab-ul-Hind, his description of India, ranging from the notation of daily observation to metaphysical discussions, a masterpiece of erudite learning

May the work of this International Congress, the future publications and the astounding archaeological discoveries which are constantly being made on both banks of the Amur-Daria, and in which the French researchers are directly concerned, enrich even more our knowledge of the History of Central Asia and our great admiration for Al-Biruni

I wish to the Congress the fullest success

DR MARIUS FRANCOIS GUYARD,
Rector
Academy of Strasbourg

JE n en forme pas moins des voeux tres sinceres pour la reussite de cette manifestation qui celebrera le millenaire d'al-Biruni II est important en effet que soit mis en valeur a notre epoque l'apport considerable des savants et des penseurs de l'Asie Centrale au progres des sciences et de la reflexion humaine

GERMANY

H E Dr Ulrich Scheske,
Ambassador of the Federal Repubiic of Germany in Pakistan

I am sending herewith my heartiest felicitations to the esteemed organizers and participants of the International Congress held on the occasion of the Millenary of al-Biruni The participation of two scholars from the Federal Republic of Germany is proof once again for the deep interest taken by generations of German students in the history of the Orient whose culture has contributed so much to our own development in Europe I wish the Congress every success (Telegram)

Prof Dr Johs Benzing,
Seminar fur Orientkunde der Johannes Gutenberg-Universitat
Mainz, Germany

WISHING a full success to this Congress

Prof Dr H Klare,
President,
Akademie Der Wissenschaften
Der GDR
Berlin, GDR

ON behalf of the Presidium, the members and scientific workers of the Academy of Sciences of the GDR, I convey our most cordial greetings to the international congress to mark the 1000th birthday of Abu Raihan Muhammad ibn Ahmad al-Biruni and wish it a good success

The Academy of Sciences of the GDR considers Abu Raihan Biruni the great learned man who embodied the state of knowledge of his time, oriented science to the practical needs of the time, and acted as a pioneer of research and gave it a strong impetus

Biruni combined and enriched the entire knowledge of his time in diverse fields such as geography and ethnography, chronological research and pharmacology, to mention only a few examples His works are also consulted time and again by modern research because in many cases they are the single, but extremely reliable source of our knowledge Moreover, Biruni's exact, critical method of work can be considered exemplary for our time

We are sure that the international scientific congress held on the occasion of his 1000th birthday will decisively enrich our knowledge of Biruni's life, personality and work, and we shall follow attentively the results of the congress Our Academy experts for Iranian and Indian philologies, Turkan research and Greek-Arab medical history will make use of the results of the congress with special interest for their research work

The Academy of Sciences of the GDR offers to all participants in the congress sincere greetings We wish the congress a good success and science new findings and progress

HONG KONG

The Vice-Chancellor,
University of Hong Kong

I regret that I cannot myself attend, but hope that you will accept this letter as conveying the sincerest good wishes and heartiest congratulation of the University of Hong Kong

INDONESIA

Chairman,
Indonesian Institute of Science (LIPI),
Jakarta

SINCERELY hope tor greatest success of the millenary of Abu Raihan Mohammad ibn Ahmed al-Biruni and of the congress (Telegram)

IRAN

H. E Dr Manoutchehr Zelli,
Ambassador of Iran in Pakistan

FOR me it is a pleasure and an honour to avail the oportunity of being associated with the millenary celebrations of the great scientist al-Biruni, who enriched the early world of science This millenary celebration which has come about an international level as a result of collaboration by Pakistan Ministry of Education, UNESCO, and Hamdard National Foundation, Pakistan, inspires us for further research and development while it also proves that intellectual achievements are supra-national and their benefits are shared by all without regard of nationality, race or religion All those who care for the history of science will welcome the initiative and enterprise of the Foundation in promoting these celebrations to commemorate the achievements of great personalities of the past Such a study and research that has been carried out by great scholars who are assembled here today is directed only to the development of human understanding of nature in an age of science and technology when the pursuit of science is often related to death and destruction in war The occasion is therefore of particular significance and all efforts to make it a success are commendable

Unquestionably, al-Biruni deserves a distinguished place of honour in the annals of mankind His great findings and achievements in various fields have contributed immediately to humanity I join my colleagues on behalf of my country in saluting his memory and the collaboration of men of learning everywhere

H E Dr Ghasem Motamedi,
Chancellor,
University of Isfahan

پیرو نامهٔ شماره ۳۱۵/۱۰ مورخ ۲۲/۷/۵۲ یکبار دیگر مراتب تأسف خود را بسبب عدم توفیق حضور در آن کنگرهٔ عالی و محـــرومیت از فیض محضر دانشمندان عالیقدری که در آن مجمع بزرگ شرکت فرموده اند بدینوسیله ابراز داشته و امید دارم که با ارسال (پیام دانشگاه اصفهان) که بمرحمت اصحاب در یکی از جلسات کنگره قرائت خواهد شد ، سهم کوچکی را در جهت بزرگداشت نابغهٔ بیهمتای جهان دانش (ابو ریحان بیرونی) ادا کرده باشم .

از صمیم قلب برای جنابعالی و همکاران دانشمندتان در برگزاری آن کنگره عظیم بین المللی موفقیتهای چشمگیر و کامیابیهای مطلوب آرزو مینمایم .

در این هنگام که با همت (بنیاد ملی همدرد پاکستان) و گردانندگان دانشمند و دانش دوست آن ، کنگره بین المللی بزرگداشت استاد استادان گیتی ، ابو ریحان بیرونی ، بمناسبت هزارمین سال ولادت آن دانشمند بی همال ، با شکوهی تمام و در خور مرتبت دانشی مردی شگفت همچون وی ، در دیار پاکان صاحب دل پاکستانی ، برگذار میگردد ، دانشگاه اصفهان با خوشوقتی بسیار درود بی پایان و سپاس بیکران دانشگاهیان این سامان را به پیشگاه یکایک دانشمندان و پژوهشگران گرانقدری کــــه در آن کنگره بزرگ تاریخی شرکت می جویند و از پرتو دانش و بینش خویش روشنگر ارزشهای بیشمار این شخصیت بی همتای علمی خواهند بود ، تقدیم میدارد .

راست است که ابو ریحان خود زادگاه خویش خوارزم را در (الآثار الباقیة) شاخه یی از باغ ایران خوانده و گرامیداشت آداب و رسوم میهنش را همچنانکــــه یاقوت دیگران آورده اند ، با آنکه هیچگاه از کار تحقیق و تالیف باز نمی ایستاده است در روزهای نوروز و مهرگان قلم از کف فرو می نهاده است ، درست است که برادران گرامی پاکستانی و هندی ما از آنروی که ابو ریحان با شیوه یی بی سابقه و بی هیچگونه تعصب تاریخ و فرهنگ و دانشهای نیاکانشان را از دستبرد زمانه محفوظ نگاهداشته است باوی پیوندی خاص دارند .

اما حقیقت این است کــــه ابو ریحان و دانشمندانی چون او را بکشور و ملت واحدی متعلق نمیتوان دانست چه آنان براستی زاده و پرورش یافته ملک دانش اند و دانش بیگمان به سراسر جامعه انسانیت تعلق دارد .

بزرگداشت انسانی که سراسر زندگانی مستمرّاً دراز خود را وقف آموختن و پژوهش و تألیف و تصنیف نموده و از این راه به پیشرفت دانش های بشری خدماتی بیمانند کرده است ، مردی که در همه دانشهای روزگار خودش استاد بوده و در زمینه های گوناگون تاریخ و جغرافیا و طبیعیات و فلسفه و پزشکی و دارو شناسی و غیره رنج ها برده و در ریاضیات و فیزیک و نجوم نوآوریهای شگفت انگیز کرده است ، استادی که هزار سال پیش و قرن ها قبل از بیکن و دکارت با شجاعت علمی درس عدم تسلیم در برابر عقاید پیشینیان با هل دانش آموخته و آنان را واداشته است تا در پژوهشهای خویش بجای اعتماد بر آراء گذشتگان اساس کار را بر مشاهده و تجربه و استدلال علمی بگذارند بزرگداشت شخصیتی از این دست در حقیقت گرامیداشت دانش است و نگاهداشت حرمت دانش را جز به بزرگداشت (انسانیت) تعبیر نمیتوان کرد از همین روی بود که دانشکده ادبیات و علوم انسانی دانشگاه اصفهان از آغاز سال ۱۹۷۳ میلادی شناساندن شخصیت ابوریحان را سخنرانیهایی چند ترتیب داد و نیز کتابی بدو زبان پارسی و تازی در باره شخصیت علمی و معنوی و انسانی وی فراهم آورد ، و نیز از همین روی بود که در تابستان امسال کنگره بین المللی بزرگداشت ابوریحان در تهران با پیروزی برگزار شد و دانشمندان کشور های مختلف گیتی فرصت آن را یافتند تا نتائج ارزنده پژوهش های خویش را بعالم دانش عرضه کنند .

و اینک نیز از همین رو است که دانشگاه اصفهان با فرستادن این پیام شادمانی و سپاس خود را از برگزاری کنگره بین المللی کراچی ابراز میدارد و پیروزی دانشمندان گرانمایه شرکت کننده را در خدمت بدانش و فرهنگ آرزومی کنند .

H E Dr Houshang Nahavandi,
Chancellor,
Untversity of Tehran

بسیار شاد هستم که کشور دوست و همسایه پاکستان مراسم تجلیل و بزرگداشت از فیلسوف و مورخ و ریاضی دان و منجم شهیر ابوریحان محمد بن احمد بیرونی بعمل می آورد و این اقدام را صمیمانه از طرف دانشگاه تهران و شخص خود به دولت دوست ما پاکستان و اولیای این کنگره تبریک می گویم و متأسف هستم که خود بعلت اشتغالات دانشگاهی نتوانستم این دعوت محبت آمیز را بپذیرم و در این مجلس علمی شریف حضور بهم رسانم .

های بسی خوشوقتی استکه همچنانکه دانشمندان که متعلق به فرهنگ و تمدن اسلامی بودند مردم نواحی مختلف از شمع وجود شان بهره ور می شدند اکنون هم ملت های مختلف مراسم بزرگداشت و تجلیل برای آنان برپا می دارند .

استادان دانشگاه تهران به سهم خود در کنگره ای که در شهر پونا امسال در تهران برای بیرونی برپا شد مقالاتی نوشتند و سخنرانیهائی ایراد کردند وکتابهای در باره زندگی و آثار علمی آن دانشمند بزرگ تالیف کردند و نیز در مراسم بزرگداشت او در کشور های دیگر شرکت و با سایر دانشمندان در این امر بزرگ همکاری کردند .

در پایان از طرف استادان دانشگاه تهران مراتب مسرت خود را نسبت بتشکیل این کنگره بزرگ اعلام و اضافه می نمایم کهما همیشه آماده برای همکاری در مورد معرفی و تجلیل از دانشمندان بزرگ و احیاء میراث علمی آنان می باشیم .

H E Dr Seyyed Hossein Nasr,
Chancellor,
Arya Mehr University of Technology

دانشمندان ایران از اینکه مجمعی با این عظمت و شکوه برای بزرگداشت پژوهشگر بزرگ اسلامی ایرانی ابو ریحان بیرونی در کشور دوست و همسایه پاکستان منعقد میشود خرسندی خود را ابراز می دارند . یقیناً این جشن در تقویت ارکان فرهنگ و تمدن اسلامی به طور کلی و فرهنگ مشترک ایران و پاکستان به خصوص سهمی مهم خواهد داشت و با احیای افکار این دانشمند بی بدیل راهی برای محققان و دانش پژوهان این منطقه از جهان که وارث فرهنگ درخشان اسلامی هستند گشوده خواهد شد فقط زمانی کوتاه از بزرگداشت بیرونی در ایران میگذرد و در واقع این مجمع مکمل مباحثات علمی در بارهٔ افکار و آثار او است که در جشن هزارهٔ او در تهران انجام یافت . امید است که با همکاری دانشمندان ایران و پاکستان و سایر کشور های اسلامی که خود را وارث فرهنگی میدانند که بیرونی را به جهانیان عرضه کرد و نیز با مساعدت دانشمندان سایر کشور ها که متوجه شخصیت خیرهٔ کنندهٔ ابو ریحان شده اند چهرهٔ واقعی این محقق و ستارهٔ درخشان آسمان علم در لحظه ای که از هر دوره بشریت بشریت محتاج به ارشاد و راهنمائی فکری و معنوی است به جهانیان شناسانده شود .

سید حسین نصر

IRAQ

H E Dr Ahmad Abdul Sattar Al Jawari,
Minister of Education

WE take this opportunity to express our highest esteem and deep appreciation for the significant role played by Al-Biruni in the various fields of science and knowledge such as history, geography, physics, medicine, astronomy, mathematics, theology and literature

We highly evaluate the great initiative undertaken by your Foundation for celebrating the Millenary of Al-Biruni whose outstanding figure as a man of letters and a scientist is well known throughout the world The Muslim World feels proud of such celebrities as Al-Biruni for their valuable contributions towards the welfare and progress of humanity

We deeply regret at not being able to participate in your celebrations in the mean time but shall not miss the opportunity to take appropriate measures in this regard through the initiative of the Iraqi National Commission for UNESCO

Wishing that your efforts shall be fruitful on the national and international level and may Allah bless your steps

JAMAICA

H E Mr Eli Matalon,
Minister of Education

THE thousandth anniversary of the birth of Abu Raihan Muhammad ibn Ahmad al-Biruni is an occasion of interest to all those concerned with education and intellectual progress

In a period of human history when many of the "advanced nations" were still groping in ignorance or lost in their dark ages, al-Biruni stood in the East as an intellectual beacon of enlightenment It gives me particular pleasure to join you in paying tribute to this great scholar, so well-versed in Turkish, Persian, Sanskrit, Hebrew, Syriac, and Arabic, and so profound in his studies in astronomy, mathematics, chronology, physics, medicine and history

He was one of the universal men, a philosopher whose scientific study of the earth's rotation, detailed and accurate calculations of latitude and longitude and determination of specific weights of metals, provided a realistic practical basis for his philosophical speculations

On behalf of the people of Jamaica, I express the hope that the unifying influence of intellectual enquiry, discovery and achievement may bind the nations in ever closer, happier, and more productive union

JORDAN

H E MR MUDAR BADRAN,
Minister of Education

MAY I take this opportunity to thank you and your colleagues for the great efforts you made in preparing for the celebration of the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni I would like, also, to extend my gratitude to every and each scholar who contributed, and is contributing, additional knowledge about the life and works of this "golden and silver tongue" scholar who combined in his sphere of knowledge many phases of natural and human sciences

I join you in reminding many educators that "The long centuries gap between the present day world and the past, tends to make us and our children forget the pioneering efforts and discoveries that are the foundations of our society, our civilization and our world This ignorance must be remedied by distribution of suitable literature on al-Biruni in educational institutions and if possible lectures should be organised in them in order to provide maximum knowledge of al-Biruni to the student community"

I regret very much that I will not be able to attend 'Al-Biruni Inter national Congress' which is going to be held in Pakistan from November 26th till December 12, 1973 But I look forward to its contributions which will be of great value to us in Jordan

Please accept my sincere thanks for your invitation, and my prayer for the success of the proceedings.

LEBANON

DR SAMIR THABIT,
Provost,
American University of Beirut

BEST Wishes for success of meetings and deliberations (Telegram)

MALAWI

DR G HUNNINGS, B A Ph D,
Vice-Chancellor,
University of Malawi

I would like to send my greetings and best wishes to you all in your deliberations Al-Biruni is clearly an important and neglected figure in the philosophy of science I hope that the congress will achieve something in the way of redressing the balance

MALAYSIA

H E KAMARUDDIN MOHD ARIFF,
Ambassador of Malaysia in Pakistan

TO the organizers of the International Congress, I offer my sincere congratulations and good wishes for the success of the International Congress The commendable efforts of the Hamdard National Foundation in holding this International Congress are worthy of support of all scholars, Muslims as well as non-Muslims The examples of scholarship left by al-Biruni should be a source of inspiration and guidance for peoples of our generation, for to quote George Sarton "his critical spirit, toleration, love of truth and intellectual courage, were almost without parallel in mediaeval time" Mankind should be proud of such intellectual curiosity, tirelessly pursued through a long life

MEXICO

DR ERNESTO MENESES MORALES,
Rector,
Universidad Iberoamericana,
Mexico City

PLEASE accept our most heartful congratulations on al-Biruni's millenary may this Congress be a success on behalf of the scientific world most sincerely (Telegram)

THE NETHERLANDS

DR A E COHEN,
Rector Magnificus of State University,
Leiden

I HOPE thec elebration of the Millenary of Abu Raihan Muhammad Ibn Ahmad al-Biruni with an international congress has been a manifestation of international good understanding between scholars from all over the world, of which the esults will contribute to the promotion and develop ment of science

NEW ZEALAND

H E MR PHILIP A AMOS,
Minister of Education,
Wellington

I HAVE studied with great interest the copy which you sent me of the Proceedings of the Regional Committees and of the National Committee I feel that the programme which has been drawn up and the recommendations which have been proposed will enable the achievements of al-Biruni to be recognized and celebrated in a most fitting manner

I regret very much that owing to pressure of parliamentary business I am unable to accept your invitation to attend the celebrations However, I have great pleasure in extending to you my very best wishes for a successful and fruitful Congress

PAKISTAN

MR A R CORNELIUS,
Former Chief Justice of Pakistan,
Lahore

YOU and the Foundation have accomplished a very great task in the organisation of these celebrations, and I send you my sincere congratulations, and best wishes for total success

A GHAFUR,
Adarts,
Karachi

HEARTIEST congratulations Wishing marvellous success for al-Biruni Conference at Karachi Peshawar, and Islamabad and Lahore (Telegram)

PHILIPPINES

MR JUAN L MANUEL,
Secretary,
Deptt of Education & Culture

MAY I send my sincere wishes for a very successful and auspicious celebration of the Millenary and the International Congress

PORTUGAL

H E THE MINISTER OF EDUCATION,
Government of Portugal
Lisbon

ON the occasion of this International Congress celebrating the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni, it is my pleasure to express my keen interest and my profound respect for his work and character Al-Biruni's contribution to the advancement of learning certainly represents not only a magnificent example of intellectual curiosity and ability but, also an actual achievement in the history of ideas and of science The significance of al-Biruni's scholarship provides us all with the evidence that human understanding and a thoughtful approach to other cultures may prove to be an auspicious condition for making progress in the quest for truth

I consequently join in the well-founded expectation of this International Congress proving that its aims will be attained, thus ensuring a wider diffusion and understanding of al-Biruni's work and of his prominent place in our common scientific heritage

SAUDI ARABIA

H E MR HASAN ABDULLAH AAL SHAIKH,
Minister for Education

السلام عليكم ورحمة الله وبركاته . . وبعد :—

اشارة الى خطابكم المؤرخ في ٢٨ يونيو ٧٣ م بصدد العيد الالفي لأبي ريحان محمد بن احمد البيروني ومؤتمر البيروني الدولي الذي سيعقد خلال المدة من ٢٩ نوفمبر حتى ١٢ ديسمبر ٧٣ م . ودعوتنا للاشتراك في ذلك ونظرا لمشاغلي في هــذا الوقت . فانه يؤسفني عــدم التمكن من تلبية هذه الدعوة مع تمنياتي لكم بالتوفيق الدائم لما فيه الخير .

H E Dr Abdul Mohsin Bin Hamd al-Ibad,
Islamia University at Medina

حضرة الأخ المكرم رئيس مؤسسة همدارد الوطنية بالباكستان حفظه الله

آمين .

سلام عليكم و رحمة الله و بركاته . و بعد .

فقد تلقينا كتابكم المؤرخ في ١٣ / ٩ / ٩٣ الذي تفيدون فيه بعزمكم على الاحتفال بذكرى مرور الف عام على العلامة ابي الريحان محمد بن احمد البيروني وطلبكم مشاركة الجامعة الاسلامية في هذا الاحتفال . وانا لنشكركم على دعوتكم الكريمة و نفيدكم باننا اوعزنا للشيخ محمد امان المنتدب من الجامعة الاسلامية للتدريس في جامعة اهل الحديث بلاهور بحضور المؤتمر المذكور و نسال الله تعالى التوفيق و النجاح للجميع . و الله يتولاكم و السلام عليكم و رحمة الله و بركاته .

SINGAPORE

Dr Toh Chin Chye,
Vice-Chancellor,
University of Singapore
Singapore

THE University of Singapore sends greetings to the Al-Biruni International Congress in Pakistan on the occasion of the Millenary Celebration of Abu Raihan Muhammad ibn Ahmad al-Biruni

The University of Singapore wishes the Congress every success

SOUTH AFRICA

Dr E Axelson,
Acting Principal,
University of Cape Town

THIS University would very much like to be represented at such an important and historic conference, but unfortunately we have nobody on our staff qualified to make a significant contribution to the proceedings of the conference

We send you our greetings and our very best wishes for a most happy and successful conference

Dr Stanley P Jackson,
Acting Vice-Chancellor and Principal,
University of the Witwatersrand,
Johannesburg

THE University is most honoured to receive your gracious invitation to attend the International Congress you are organising to mark the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni Professor Bozzoli will not be able to accept the invitation to your International Congress, which, judging from the plans and programmes you have sent us, promises to be a most exciting gathering of scholars

The University has great pleasure in sending you its cordial good wishes on this important occasion It is most appropriate that the scientific and philosophical writings of the eminent old scholars be studied and that we acknowledge our important debt to them Your invitation to academics from all parts of the world to share in the celebrations in honour of the erudite man of Central Asia will, I am sure, mark the establishment of valuable academic bonds between scholars around the world

SWITZERLAND

MR WERNER WAHL,
Consul-General of Switzerland,
Karachi

WE are here today in a monument to greatness Al-Biruni is a symbol, an assurance From humble beginnings, he climbed one rung at a time to national and international acclaim Not for himself, not in selfish causes, but in dedication to others He broke new ground for all races in every branch of knowledge and science If at times we feel dejected, discouraged with the thought that all the odds are against us, then regardless of station, position, race or creed, we need merely remind ourselves of the Old Masters such as al-Biruni

International cooperation in all fields of life is the key to peace It must come about and it must progress from year to year, or the world must be the poorer by reason of that failure In order to share scientific progress, free flow of knowledge is of paramount importance This requires intensive personal contacts

Because of the spirit of fraternity and common purpose which will reign at this Congress, I have no doubt that the words spoken here, the informal words equally as important as the formal, are even now finding their orbit around our planet, inviting thousands of men and women of energy and faith to be of our number int he conquest of the future in science's name However, the final test of science is not whether its accomplishments add to our comfort, knowledge and power, but whether it adds to our dignity as men, our sense of truth and beauty It is a test, science cannot pass alone and unaided

Having regard to the number of her inhabitants, it may be claimed that Switzerland occupies a place of honour, as far as science is concerned It must be remembered that her population is equivalent to that of a small German Land, or of a group of three or four French "Departments", or a State in the United States of America

It is by this yardstick that we must measure her contribution to the development of science, technology, philosophy and the arts in the world It is essential that Switzerland should continue, in this international

society, to be what she has always been available for certain tasks, placing at the service of humanity a type of man whose usefulness has been demonstrated by history

I wish your Congress the very best of success

TOGO

H E Mr B Malou,
Minister of Education

IL ne me sera pas possible de faire representer le Togo a ces importantes manifestations Je souhaite cependant qu'elles connaissent le plus grand succes, et vous serais tres oblige de bien vouloir me communiquer les decisions finales du Congres

TURKEY

H E Mr Orhan Dengiz,
Minister of Education

EBU'R Reyhan Muhammed b Ahmet el Biruni, born in Kas near Hive in Harizm, is a splendid personality to be proud of in the brother countries of Islamic culture and civilization

He, who learned Arabic and Persian, the languages for literature and science of that era, Greek and Syriac (Suryani), the languages of philosophy, and Sanskrit, which was the medium of most of his original work, was a matchless scholar He, who was a mathematician, physicist, astronomer, geographer, geologist and literature made singular achievements in each of these fields We pay homage to this brilliant star which we have inherited from an illuminated age

The great scholar el-Biruni, one of the unique representatives of liberal concepts and Islamic humanities wrote with an objective mind and tolerated all ideas and beliefs

We believe that his superior personality and magnificent work will be the focus to strengthen the already existing cultural ties among Turcs, Iranians, Pakistanees and Arabs and will bring these brother countries even closer together

I wish all the success to the president and eminent members of the International al-Biruni Congress, in which I am not able to participate, in their scientific work However, it makes me very happy to have this opportunity of sending the best wishes and regards of the Turkish nation to brotherly Pakistan

H E Mr Erdem Erner,
Ambassador of Turkey in Pakistan

THE organisers of al-Biruni International Congress certainly deserve congratulations on making arrangements for observing the Millenary of Abu Raihan Muhammad Ibn Ahmad al-Biruni, for this will provide an opportunity to distinguished scholars of discussing the life and works of the great Muslim mathematician, astronomer, geographer, philosopher and historian

Al-Biruni is one of the few great scholars who had profound learning of diverse subjects and to whom mankind owes a great deal Apart from his works on other subjects, he has written books on India and his "Tarikhul Hind" was often known as "Plato on the doorsteps of India" When al-Biruni came to this Sub-Continent with Sultan Mahmud of Ghazni, he even learned Sanskrit in order to acquire greater knowledge of the religions, philosophy and customs of the people here

Although a devout Muslim, al-Biruni never let his own beliefs and thinking affect the objectivity of his learning and research In the introduction of his well-known translation from Sanskrit of "Patanjali", al-Biruni says "People have different ideas and beliefs, and the progress of this world depends on the diversity of these ideas" This, indeed, is a great lesson to tolerance which is the key to survival and prosperity of mankind

UGANDA

MR G J O EYOKU,
Permanent Secretary,
Ministry of Education

WE regret, however, that at the moment we are unable to participate in this auspicious International Congress We trust, however, that this Congress to celebrate the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni will be successful and fruitful This success is almost certainly assured by the elaborate arrangements which your various committees have made in preparation for the Congress

You have our best wishes and regards in your efforts to ensure that credit is given where it is due

UNITED KINGDOM

MR P B S MCENTEE,
Consul-General of U K
Karachi

LUCKILY for mankind, but all too rarely it seems - succeeding centuries have produced men of world stature whose contribution to human progress transcends all national considerations Such a man was al-Biruni, probably one of the most comprehensive scholars that Islam ever produced It is a humbling thought that it was one thousand years ago that this great philosopher, scientist and historian was carrying on his work - and it is appropriate that his thousandth anniversary should have been chosen as the occasion for an International Congress to do him honour It is also particularly appropriate that this great Muslim country should be hosting this Congress

I am delighted that a learned international gathering of this kind should be meeting to shed new light on al-Biruni's works and that it will be exploring more fully the impact of his work on thought today

But I should like also to pay tribute to the late Hakim Hafiz Abdul Majid whose vision and activity led to the creation of the Hamdard National Foundation - whose ideals and generosity have made this Congress possible

I wish you a successful and rewarding conference.

Dr Joseph Needham,
Master,
Gonville & Caius College,
Cambridge University

WARMEST wishes success al-Biruni International Congress (Telegram)

Dr Charles F Carter,
Vice-Chancellor,
University of Lancaster

I was privileged to receive the invitation and also to read something of the work and intentions of your committee The University of Lancaster which has introduced into its curricula the study of the history of science and has a department and an Institute of Arabic and Islamic studies, applauds and admires the work that is being done to remind the world of the contribution made by the great Arabic polymaths to the development of thought and knowledge Your own institute's enterprise in interpreting anew, in expatiating in modern terms, the medical wisdom, or rather the medical experience, of generations of scholars and practitioners, similarly commands our approval and elicits expressions of congratulation and benediction Too often in these self-adulatory times do we forget the feet on which we stand and by which we progress When age applies its restrictive calipers, when in pursuit of an idea we can move no further, we remember, and remember to understand, the blessings of the limbs that support us We then look down to the origins of our doctrines, or our dogmas, and see them in fresh light It is this restatement of old themes in new forms that is particularly appropriate on the occasion of the celebration to which we were so graciously invited

We can but express now the hope that the occasion was one of fitting enjoyment and that it has successfully revived, as we are sure it will have done, the study of the works, of a great scholar and of his forerunners and successors in a remarkable tradition of which we are all, knowingly or unconsciously, the fortunate beneficiaries

PROF. C. E BOSWORTH,
Deptt of Near Eastern Studies,
University of Manchester

MAY I take this opportunity to wish you well in the organisation of the Congress? I feel sure that it will be a great success

UNITED STATES OF AMERICA

MR M GORDON TIGER,
United States Consul-General,
Karachi

IT is a privilege, on behalf of the United States Mission in Pakistan, to congratulate Hakim Mohammed Said on the organization of the international conference to observe the millenary of one of the greatest men in Islamic history—Abu Al-Rayhan Muhammad al-Biruni Although al-Biruni lived one thousand years ago, his tremendous accomplishments in a wide variety of fields are recognized today by scholars throughout the world, in both the East and the West Today, scholars of South Asian affairs unanimously acknowledge, for instance, that al-Biruni's account of the Sind—and his comments on the social, religious and economic systems he observed in this part of the subcontinent—constitute even in the twentieth century one of the most valuable analyses ever made of the land and people of what is now Pakistan

Americans who esteem intellectual achievement also join this year in honoring the accomplishments made by al-Biruni during the 78 years of his life—his contributions to medical botany, marine biology and pharmacy, and particularly to astronomy, mathematics and cultural history

It is fitting—as well as gratifying—that scholars from eight cities in the United States have come to Karachi to pay tribute to this eminent Muslim as official American delegates to the al-Biruni International Congress

THE PRESIDENT & FELLOWS
Harvard University, Cambridge,
Massachusetts

WE have the honour to convey to you the congratulations of Harvard University on the occasion of the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni

We are confident that the International Congress will be an outstanding success and that the advancement of scientific knowledge by the Peoples of Central Asia will continue for many centuries to come

We beg you to accept the best wishes of Harvard University on this important occasion

PROF AINSLIE T EMBREE,
Associate Dean,
School of International Affairs
Columbia University in the City of New York

I have read the program with great interest and you have brought together a quite extraordinary group of people for this momentous occasion I will be giving whatever assistance I can to the al-Biruni celebrations that are to be held here I shall look forward to seeing the papers that will be presented at the Congress

With every good wish for its success

E T YORK, JR,
Interim President
University of Florida

THE University of Florida extends its greetings and good wishes to the International Congress celebrating the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni and commends the account of the development of science which is in preparation

DR MUHSIN S MAHDI,
Jewett Professor of Arabic,
Harvard University

I take this opportunity to congratulate you for the splendid work in preparing for the Congress and to present my greetings and best wishes to the prominent scholars who are fortunate to be with you in Karachi on this great occasion

OTIS A SINGLETARY,
President,
University of Kentucky

REGRETS that he is unable to attend the International Congress in celebration of the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni November 26th—December 12th, 1973 Both on behalf of himself and the entire staff of the University of Kentucky extends greetings and best wishes for a successful and meaningful occasion

JOHN E CORBALLY, JR,
President,
University of Illinois

ON behalf of the University of Illinois, I extend congratulations and felicitations on the forthcoming celebration of the Millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni and the International Congress to be held in Pakistan November 26 - December 12, 1973 I regret that official University commitments will make it impossible for me to be with you in person for the Congress

I send all good wishes for the success of this important Congress

Dr R B Winder,
Dean, Faculty of Arts & Science,
New York University

I do wish to tell you how much I appreciate your having invited me to attend the millenary celebrations of al-Biruni in Pakistan, November 26 through December 12, 1973 Unfortunately, I am overwhelmed by administrative duties, and must respectfully decline the invitation My declination will not represent any loss to the success of the Congress, but it will represent a great loss for me I have never had an opportunity to visit Pakistan, and I dared hope that I might make it on this occasion

I again congratulate you on the lofty conception of this Congress and of your support for scholarship I shall be with you in spirit if not in fact

UNITED SOVIET SOCIALIST REPUBLICS

H E Mr A Rodionov,
Ambassador of the USSR in Pakistan

IT gives me great pleasure to learn that an International Congress to celebrate the millenary of Abu Raihan Muhammad ibn Ahmad al-Biruni is being held by the Ministry of Education, Government of Pakistan, in co-operation with UNESCO, under the auspices of the Hamdard National Foundation, Pakistan at Karachi

Born in a suburb of Khorezm, the great Central Asian Scientist Al-Biruni made a considerable contribution to the development of a number of sciences—astronomy, mathematics, physics, mineralogy, pharmacology, history, ethnography among them The humanity highly appreciates the versatility and broad scope of the scientist's interests, the diversity of his talents.

In the Soviet Union this red-letter-day in the history of world science is being celebrated on a grand scale In Moscow and other cities, meetings and conferences under the auspices of the USSR Academy of Science and Academies of Sciences of Central Asian Soviet Republics and Kazakh SSR have been held, a considerable number of books on Biruni's work, have been published, a collection of Biruni's works is being brought out A popular science film on Biruni's life and activities has been produced All these facts show, that the Soviet people have got deep respect towards one of the most prominent scientists of the East

I wish the International Congress every success

ZAMBIA

S J Kazunga,
Permanent Secretary,
Ministry of Education & Culture,
Republic of Zambia

I would like to convey to you on behalf of the Minister, my sincere wish for the unrestricted success during the occasion I have no doubt that the occasion will not only honour the great works of pioneers and path finders in the development of science, but that it will also serve as a forum through which problems in various aspects of this development will meet their solutions

INTRODUCTORY ADDRESS

HAKIM MOHAMMED SAID

IT is a great honour & privilege for me to welcome here this evening eminent members of the intellectual community from different parts of our country and from all over the world, who have responded to our invitation to participate in this Congress I welcome you with all my heart and thank you for allying yourself with a scholarly cause namely, the celebration of the millenary of al-Bīrūnī You have made special studies on al-Bīrūnī We are eagerly looking forward to fruitful discussions in the course of the Congress at Karachi, Peshawar, Islamabad and Lahore

The Inauguration is being performed by Her Excellency Begum Ra'ana Liaquat Ali Khan, Governor of Sind, who ever since the inception of Pakistan has been actively associated with Pakistan's progress (not only during her illustrious husband's lifetime, whom she devotedly assisted, but also after the great leader's tragic assassination) Herself an educationist, she has always encouraged cultural & intellectual pursuits by her keen interest, unfailing sympathy and gracious guidance On behalf of the Sponsors of the Congress —the Ministry of Education, Government of Pakistan, UNESCO, and the Hamdard National Foundation, the National Committee and all those present here, I express profound gratitude to Her Excellency for her gracious acceptance of our invitation, inspite of her preoccupations and responsibilities, to inaugurate the al-Bīrūnī International Congress

The dust of centuries buries in oblivion, the findings of those pioneers who have kindled the fire of civilization We, who walk in the glow of that fire, must not forget the torch bearers of the past Al-Bīrūnī enriched this world with his presence and discoveries A thousand years have passed since his birth We gather here today filled with the common desire and great purpose to pay adequate tribute to his memory I have every confidence that this exalted assemblage of personalities will plan a campaign and course of action to make the achievements of al-Bīrūnī useful and inspirational to the whole world

The celebration of the Millenary is a part of the Project for the Study of the Civilization of the Peoples of Central Asia started by UNESCO in 1966 Scientists were wont to reject traditions of the past, as more likely to block than to assist progress But the troubles of the times have shown the inescapable

link between them and the advance of science, and have focused attention on the historical aspect of science If we wish to trace how the advance of science has altered the whole frame of human thought, it would be necessary to go back to the Old Masters, without references to whose findings, the phenomenal advance of science would not be possible

The purpose of the UNESCO Project is to make known better the civilization of the peoples of Central Asia through studies of their archaeology, history, science and literature The Central Asian region includes Pakistan, Afghanistan, Iran, Mongolia, northern part of India and several Asian Soviet Republics Pakistan has been assigned the topic of 'History of Development of Science', under the Project

The Hamdard National foundation, Pakistan, dedicated to the task of historical research, has been doing whatever it can to highlight the achievements of the pathfinders The millenary of Ibn al-Haitham, Father of Optics, celebrated in Pakistan in November 1969 was one link in the chain of this effort

There is no doubt that the peoples of Central Asia substantially contributed to the growth and ramification of many scientific theories and technological practices in vogue in the ancient and medieval world The period chosen for the study of the development of science in Central Asia is a distinct one, in which many strands of scientific thought were woven into a rich tapestry of knowledge and civilization and many important ancient works in Arabic, Persian and Sanskrit were brought to light There was in this period, considerable cultural and scientific intercommunication in the countries of this region

Knowledge of the contribution of the Peoples of Central Asia has been so far restricted to the scholarly circles It is our intention to make specialised studies on the one hand, and supply better, but critical, information for the general public, on the other

Our efforts in this direction began in full swing almost two years ago We have been in correspondence with thousands of scholars throughout the world and I have made personal contacts with many The first reward of these efforts was the formation of Regional Committees in many countries and a National Committee for Pakistan (whose enthusiastic chairman is Mr Abdul Hafeez Pirzada, Federal Minister for Education), and the second was our initiation of a Resolution at the Beirut Committee meeting, that the millenary of al Bīrūnī must be celebrated in all the member countries of UNESCO This resolution was tabled by Pakistan, Iran and Egypt, at the UNESCO General Meeting, held subsequently, and passed unanimously

Our caravan has been journeying successfully and has culminated in the al Bīrūnī International Congress, which commencing this morning is sponsored

by the Ministry of Education, Government of Pakistan in co-operation with UNESCO, and is being hosted and held under the auspices of the Hamdard National Foundation, Pakistan The unfailing assistance and valuable co-operation of Mr Qudratullah Shahab, Secretary to the Government of Pakistan, Ministry of Education and Dr S M Zaman, the Executive Secretary of the Pakistan National Commission for UNESCO has made it possible to organise the Congress at an international level Further if the late Professor Hameed Askari had not devoted his time, and my other colleagues had not persevered with me, day and night, this dream of the International Congress could never have come true I express my heartfelt gratitude to all of them

Above all, dear Colleagues! Your alliance and co-operation will make this journey into the past a thrilling and remarkable contribution to the study of the civilization of the peoples of Central Asia

Al-Bīrūnī was a many-splendoured personality—theologian, historian, geographer, physician, physicist, astronomer, mathematician and poet Although very little is known of his ancestry and childhood, he seems to have commenced scientific studies very early, and he had the good fortune to be taught by the eminent Khwārazmian astronomer and mathematician Abū Naṣr Manṣūr His sojourn in the courts of Khwārizm and later in Ghaznah seems to have brought about the flowering of his genius Whatever his lineage, wherever his birth, al-Bīrūnī by virtue of his pioneering ideas and works belongs to all nations and all times He was a citizen of the world, a cosmopolitan in outlook, having a great respect and feeling for the Arabian and Persian languages the Greek Sciences and the institutions of Indian culture and civilisation He was a seeker after truth, and in his quest through the limitless world of the mind and limited world of the ancients, discovered many things, many facts which we take so much for granted today Is not his calculation of the diameter of the earth barely 12 miles away from the truth, the trisection of the angle, that speed of light is far greater than that of sound, accurate determination of latitudes and longitude, to mention a few facts—are they not profound discoveries? Besides his own contributions in many fields, he has started a new scientific disciplines viz the scientific and comparative study of world religions—a study which evokes so much interest and to which is attached so much importance throughout the world today He had a brilliant analytical and critical mind and subjected the ideas of the great masters of antiquity such as Aristotle, Ptolemy, Galen and Theophrastus to a minute examination for their veracity and credibility Above all he had an open, universal mind and a keen desire to drink deep from the Fountain of Truth, whatever its source It is this extraordinary quality that sets him apart from his contemporaries and reserves him a place among the immortals of the world

The object of al-Bīrūnī International Congress is to determine areas of study to be undertaken in future in a systematic way, so that more light will be

thrown on the contributions of the peoples of Central Asia in the development of science, in general, and that of al-Bīrūnī in particular This can be secured if UNESCO constitutes an International Committee to coordinate and promote studies on al-Bīrūnī and the Central Asian scientists, if critical editions of all the scientific works of al-Bīrūnī be brought out, by collating the different manuscripts concerned, so that they would serve as authentic source materials for further interpretative studies, and translations of al-Bīrūnī's scientific works into the important languages of the world be made The Hamdard National Foundation in this context has translated from the Arabic into English and published on the occasion of this Congress the *Kitāb al-Ṣaydanah* one of al-Bīrūnī's mojor works with the title of *al-Bīrūnī*'e *Pharmacy and Materia Medica* The second vol with an additional commentary by Dr Sami Hamarneh of Smithsonian will be ready by July 1974

Al-Bīrūnī taught, that human potential, individual dignity and a liberated human spirit can sustain and strengthen a great civilization, that it lies within the power of man to create edifices of shining splendour, from which the glory and greatness, of which human thought and feeling are capable, shall spread a light unmixed with darkness, filling men's hearts with joy and their thoughts with clarity Such a world is possible if we have the stamina to hold to our purposes through times of confusion and controversy

INAUGURAL ADDRESS

BEGUM RA'ANA LIAQUAT ALI KHAN
Governor of Sind

IT is a matter of great pleasure for me to address the al-Bīrūnī International Congress in the Islamic Republic of Pakistan's Province of Sind, where there are assembled today many distinguished scholars and intellectuals, not only from within the country, but from many different countries of the world The holding of this illustrious Congress in Pakistan, in connection with the history of science and learning, has the explicit purpose of paying tributes to that notable personality in the world of science and scholarship—Abū Raiḥān Muḥammad ibn-e-Aḥmad al-Bīrūnī—on the occasion of the one-thousandth anniversary of his birth But the basic aim and object of this historic Congress is for Pakistani and non-Pakistani scholars and intellectuals alike to make an intensive assessment of the many-faceted genius of al-Bīrūnī—his imperishable scholarship his scientific achievements his invaluable contribution to the sovereignty of knowledge and service to mankind without prejudice or discrimination of colour, caste or creed as also to bridge the generation's gap which has occurred between the scientific precepts of yesterday and today with their effects upon the continuity of both history and science

This undoubtedly is a difficult but necessary task confronting this international Congress, but I am confident that such eminent scholars and intellectuals from all over the world, as those who have graced this occasion with their presence, will do full justice to the subject

Al-Bīrūnī was truly a man of many parts, and the more profoundly we study him, the richer his intellect seems to be He was a genius of the first magnitude—an intellectual who made the fullest use of his faculties He was a mathematician, an astronomer, a phillosopher, a sociologist and historian who also worked on geography, medicine, physics and numerology During the last days of his life he brought all his wisdom and experience to bear upon his greatest work, known to the world as, "Kitāb al-Saydanah", which makes pharmacy and materia medica its special subjects of study

Unquestionably, he stands in the front rank of those great minds who were capable of making the fullest possible use of their God-given qualities and who,

through the exercise of their full physical and spiritual facilities, set out to unlock the mysteries of nature to open up fresh paths to human welfare and progress He was a mathematician and historian of very considerable merit and, in the field of science

Pakistan is anxious to rediscover al-Bīrūnī's works, and to make enough copies of them for a wide distribution to libraries throughout the world, so that experts are enabled to make further research on him It is desirable that this legacy of wisdom becomes the responsibility and privilege of the scholars of all nations as an appreciation of the legacy which al-Bīrūnī has left behind, by putting this wisdom to good account, and establishing how far and how well al-Bīrūnī's scientific thought and achievements have influenced the scientific thought of today

I am very happy to see that eminent scholars from all over the world are present at this congress here We welcome them most warmly and feel proud of the honour they do us I sincerely hope that Pakistani and non-Pakistani scholars and intellectuals will continue in mutual collaboration so that greater and richer knowledge may develop in the wake of their fruitful cooperation, as a service to mankind

In 1969 the Millenary of Ibn al-Haitham was celebrated in Pakistan under the auspices of Hamdard National Foundation, which was the first and the basic move in Pakistan in the direction of the history of medicine and science Scholars in Pakistan treated the subject with due importance and it soon came to be established that Ibn al Haitham was, indeed, the Father of Optics Having published and circulated to world libraries the proceedings of the Ibn al-Haitham Millenary, it is now well nigh impossible to ignore his work as an asset for any research in this subject

The *Millenary of al-Bīrūnī* and this *International Congress* is another important step in the same direction, which has come about as a result of collaboration by the *Pakistan Ministry of Education, UNESCO* and *Hamdard National Foundation, Pakistan* This has succeeded in obtaining the cooperation of prominent scholars who are present here today, at what might be called an historic assembly

It is for this reason a matter of great happiness and pride for me to inaugurate this *International Congress* which I now do It is my fervent hope that it may be a scientific success as well as an effective means of levelling the road to international peace and brotherhood May it prove to be a strong and unshakeable corner-store for a happier human society based on mutual trust, love and co-operation I thank you

INAUGURAL ADDRESS

MR FAZAL ELAHI CHAUDHRY
President, Islamic Republic of Pakistan

IT is a great pleasure for me to join with you on this occasion of celebrating the millennium of the birth of the great Central Asian scholar Abū Raiḥān al-Bīrūnī By celebrating his birth we are not only honouring the great man of learning but also valuing the scholarship that he contributed and recognising its merit and our indebtedness to him for all that he did to teach his contemporaries and the generations that followed him By paying tribute to him we are honouring science, scholarship and above all teaching, for which alone al-Bīrūnī dedicated his whole life He was born in a far off place in Khwārizm in A.D 973, but he lived to play a scholarly role that could illumine the view of his compatriots and contemporaries and lit a new path for those who came after him His indefatigable thirst for knowledge enabled him to master the sciences of East and West, digest them and present them to the scholars in a language that was then internationally understood His contributions related to different fields of studies but his deep interest in humanity had taken him far away from his own country and created in him a curiosity and an abiding devotion to acquiring knowledge about other men His enquiry was scientific, devotion passionate and findings so deeply imbued with intellectual penetration that no one could doubt the zeal with which he tackled the problems Independent in his thoughts about religion and philosophy, he is a friend of clear, determined, and manly words He abhors half-truths, veiled words, and wavering action Everywhere he comes forward as a champion of his conviction with the courage of a man He was deeply interested in people, their society, their behaviour, manners and customs, their philosophy, religion and thought, the world in which they lived and the universe of which they talked, and the various sciences that were used in the service of man And yet al-Bīrūnī was not a utilitarian His studies were to acquire knowledge and his aim was to disseminate this knowledge to others He was a great historian but his history was not of the routine type of chronologies His history did not relate wars and conquests but the life of the people By all qualifications al-Bīrūnī can be said to be a scholar of humanity Today we are celebrating his birth to honour this great scholar and to remind us of the value of humanity that shines so much in his scholarship

Al-Bīrūnī was a professional mathematician His contributions in astronomy and geography have been acknowledged by his contemporaries He was also a physical scholar, and published works on most branches of natural science, optics, mechanics, mineralogy and chemistry His mathematical proficiency enabled him to arrive at new theories about the geography of the world and he could correctly calculate the latitudes and longitudes of the different places He put forward the hypothesis of the southern ocean and the possibility of another land mass on the other face of the earth These scientific contributions apart, he had a deep grounding in the knowledge of the past And yet he did not blindly accept the traditions of the earlier ages, he made a study of them in order to understand and criticise them He desired to sift the wheat from the chaff and he discarded everything that militated against the laws of nature and reason

Al-Bīrūnī lived in a period of history which is generally remembered as mediaeval age Mediaevalism is a word that is usually associated with decline in human creative thought and science But such a notion of that epoch, which originated with the Renascent historians of Europe, may be true as far as that part of the world is concerned In Asia the contemporary period was bristling with new developments The forces that were generated by Islam had lit a new torch and given a new meaning to human sciences Al-Bīrūnī was a product of this new environment in which the scientists of Central Asia made equal contribution Several eminent scientists stand out prominently from this region They have all contributed in their particular fields but al-Bīrūnī was a versatile scholar He was a master of natural sciences and was equally well adept in social and human sciences His love of literature was as varied as his devotion to different branches of learning His proficiency in a number of languages qualified him to get to the original sources and he could talk with equal mastery of Greek philosophy, Sufi mysticism and Hindu religious beliefs and thoughts His comparative study at once threw open the floodgates of knowledge in the civilisations of Greece, India and the Islamic world In him we find united the sciences of these three civilisations With his vast erudition he could bring the light of one source to bear upon the ideas held by other people and thus illumine the path and clear the misunderstandings Credit goes to him to introduce for the first time the correct knowledge of the Hindu sciences in the Muslim world And for this he had to take great pains as he says "I have found it very hard to work my way into the subject, although I have a great liking for it, in which respect I stand quite alone in my time, and although I do not spare either trouble or money in collecting Sanskrit books from places where I supposed they were likely to be found, and in procuring for myself, even from very remote places, Hindu scholars who understand them and are able to teach me"

Al-Bīrūnī not only acquired the Hindu sciences from them but also translated for them other works of science His knowledge of Sanskrit eminently qualified him to give a first hand information about the Hindus This knowledge

he acquired at a time when the country was faced with the horrors of war Despite these unfavourable circumstances al-Bīrūnī devoted himself to studies It is a matter of pride for us that this great scholar spent more than ten years in the different cities of Pakistan to meet the people and get the first hand knowledge about the local conditions, the beliefs and thoughts of the people His researches have given to the world an insight into the contemporary society

While we honour the great man, we are happy to note that UNESCO included in its programme this great scholar as one of the world luminaries to whom fitting tributes could be paid by republishing his works and following his devotion to learning and service to humanity This programme is a part of the study of the civilisation of the peoples of Central Asia It is hoped that with the foundation of an International Association for the study of human sciences in Asia under the auspices of UNESCO, we will march ahead to a new road to progress Let that road be enlightened by the scholarship of Abū Raiḥān al-Bīrūnī

CONCLUDING ADDRESS

HAKIM MOHAMMED SAID

I have great pleasure in welcoming you all once again in the last session of the al-Bīrūnī International Congress particularly those delegates who are participating in these deliberations from outside of Pakistan These international conferences have manifold advantages and while they lend to serious pursuits of academic research they provide an opportunity for world academicians and learned scholars to exchange ideas for the common end of the cultural heritage of mankind

It is rather ironical and contradictory that while Central Asia, between ninth and fourteenth century, experienced a glorious period of advancement in science, culture and other disciplines its achievements are shrouded in the mist of history The UNESCO Committee for Study of Central Asia deserves commendation for its decisions to throw light on the achievements of this period and to bring to light the valuable works of the scholars of that period The USSR performed the pioneering work in this connection and was joined later by Afghanistan, Pakistan, Iran, India and Mongolia They divided the work among themselves and entrusted various sections of studies to highlight the period to different countries Pakistan has taken responsibility to organize researches relating to the contribution of that period to the promotion and advancement of scientific knowledge It is hoped that soon China and Turkey will join hands with us and thus our efforts will be speeded up

Among the outstanding personalities of Central Asia of that period is Abū Raihān Muhammad Ibn-Aḥmad al-Bīrūnī The UNESCO put him on the priority list This coincided with the efforts of the Hamdard National Foundation which had already initiated efforts to highlight great scholars and researchers of the Muslim world In 1969 the 1000th anniversary of Ibn al-Haitham was celebrated under the auspices of the Hamdard National Foundation all over the country and announcement was made that in 1973 the Foundation would organize programs featuring the thought and great works of al-Bīrūnī In Iran, under the guidance of Shahinshah Arya Mehr, a study of al-Bīrūnī was started

As a humble student of science I am deeply interested in the accomplishments of those great men on whose findings our modern knowledge is based,

Before 1969 few people recognized the status of Ibn al-Haitham as the father of Optical science and most of the theories and findings in the field of optics was attributed to Western scholars The 1969 Ibn al-Haitham celebrations put things in right perspective and the contribution of that great scholar was duly recognized The work of Ibn al-Haitham, the ***Kitab al-Manazir*** has now been translated by the well known scholar Dr Abdul Hamid Sabra and the book, now under print, certainly would be a great addition to the treasury of knowledge

When we had decided to embark upon the study and scholarly research on al-Bīrūnī we meant to do it on a national level But when I travelled to Europe and the United States, twice during the last three years and found that the Western scholars reciprocated our interest I decided to move the internationally known scholars and scientists to join us in our pursuits Our Beirut meeting in 1972 was the corner-stone in this direction where we decided to seek the cooperation of UNESCO in our efforts The resolution was jointly presented by Iran, Egypt and Pakistan in the UNESCO session and was approved

Later Pakistan decided to sponsor an international congress on al-Bīrūnī Iran decided on a similar action and this was followed suit by some other countries Thus the attention of the academic world was focused on al-Bīrūnī This is what we are aiming at through these deliberations I am greatly indebted to the scholars and researchers, from many countries of the world, who have responded, enthusiastically, to our invitations and have participated in the congress I can say, without any hesitation, that the level of discussions has been very high and new avenues of the works and findings of al-Bīrūnī, hitherto hidden were opened up to the world The congress has, certainly, given added momentum and zeal to the scholars and it is rightly hoped that the interest promoted through this Congress would go on increasing day by day The Congress would provide the link between the modern times and that glorious period of science one thousand years ago

The success of this conference owes a great deal to the unflinching support given to it by Pakistani scholars from November 26, 1973 until today, December 10, 1973 They have worked ceaselessly towards its success and we are grateful to them This is the first Pakistani conference on the history of science which has held its sessions in four different cities of the country The program in each city was organized by regional committees whose members devoted most sincerely to the success of the program inspite of heavy demands upon their valuable time They deserve our sincere gratitude

We elicited the support of UNESCO and our Ministry of Education and they extended us their full cooperation, which undoubtedly raised the status of the International Congress The Hamdard National Foundation is proud to act as host to the delegates and participants from abroad who most willingly

responded to our request to participate in the conference. We have tried our best to offer them all comfort and facilities but if we have failed, at any stage, we request them to pardon us

I must take this opportunity to voice my gratitude and thanks to Pakistani news media, newspapers, radio and TV, which have fully co-operated with us in our efforts to open up new horizons of human knowledge Last but not the least, I am indebted, in this great task, to my co-workers and colleagues of the Hamdard National Foundation who put their entire heart and soul in making the congress a great success It may not be possible to name everyone in this organization but I must mention Mrs L A D'Silva, Mr Khalid Latif, Hakim Mufti Sadiq Anis, Mr Matinul Hasan Mohani and Dr Rana Ehsan Elahi without whose co-operation I would not have been able to shoulder the responsibility

During deliberations at Karachi's historical session of this congress we have reached to a decision to establish an Institute of the History and Philosophy of Science All the delegates, Pakistani and non-Pakistani have fully supported the establishment of such an Institute and have graciously agreed and signed the draft as Promoters

We are about to conclude the International Congress on al-Bīrūnī and to say goodbye to scholars and learned researchers with whom we were associated for the past several days We will be separated from each other soon but the redeeming feature is that the academic and spiritual bond established through this congress would be a source of inspiration for all of us The understanding between Pakistani scholars and the great scholars from outside, promoted through this congress, is certainly a great achievement which would stimulate further co-operation in various other scientific and academic pursuits

PAPERS

HISTORY SECTION

SOME GLIMPSES OF AL-BĪRŪNĪ AS A GEOGRAPHER*

PROFESSOR NAFIS AHMAD
University of Islamabad

BURHĀN al-Haq Abū al-Raiḥān Muḥammad Ibn Aḥmad popularly known as al-Bīrūnī was a great scientist and lived and made his contributions in the 4th/5th centuries of the Islamic Calendar But the quality and range of his work is so outstanding that it undoubtedly constitutes a heritage of the world He was a scientist as well as a humanist and all branches of human knowledge attracted his attention He commenced his writings at the early age of 28 and was 45 years of age when he was brought to Ghaznah by Sulṭān Maḥmūd in 407 A H /1017 A D Later he spent about 14 years in India travelling extensively throughout the Muslim domains

He wrote on numerous topics and subjects ranging from philosophy, ethics, and humanities to social and physical sciences His knowledge of geography was remarkable for a clear understanding of the physical and cultural aspects which form the core of the environment Spread over his numerous books are his remarks and discussions on physical geography (mathematical geography, geology, mineralogy, river morphology, soils, sediments, meteorology, hydrology and bio-geography), and human geography (society, culture, archaeology, economic wealth) In Kitāb al-Hind he has two chapters viz, XVIII and XXXI in which a good deal of geographical material is found But elsewhere in many other pages such material exists

To collect these references from his works and sort them out is a stupendous task which must await the collaboration of many scholars in different disciplines In this short paper an attempt has been made to extract some typical examples of his geographical knowledge in relation to the Indian Sub-Continent and many other general remarks of geographical nature The source is primarily his monumental work (تحقيق ما للهند) popularly known as Kitāb al-Hind (al-Bīrūnī's India) which was completed in 421 A H /1030 A D at Ghaznah (Taḥqīq mā al-Hind)

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* The text used here mainly is al Bīrūnī's India
Lahore edition 2 Vols , 1962 Edward C Sachau's earlier edition, London, 1914 has been consulted also

GEOGRAPHY OF INDIA

Physical Geography

The sea which is bordered by the continent of India is called the Indian Ocean [1] The coast of India begins near Tiz in Makran and extends in a south eastern direction to Daibul[2] (al-Daibal) and thereafter stretches via Katch and Somnath to the Gulf of Cambay and further south to Thana and onward to the bay in which lies Singaldib (the island of Sarandib - Ceylon) [3]

Islands in Indian Ocean

Al-Bīrūnī mentioned a number of islands in the Indian Ocean Alwaq waq, Kumair (Madagascar), Ramm and Diva (Maldives and Lacadives) Ceylon was called by him Singaldib or Sarandib Mention is made of the chain of islands (now called Adam's Bridge) which extend from Ramsher (Rameshvaram) toward Ceylon Here is also related the story of Sita's exile and Rama's adventures in overcoming Ravana and his monkey devils [4] He mentions other islands in this ocean lying nearer to China than India, they are Zabaj (Java group) known to the Hindus as Suvarna-dvipa i e the gold islands Pearl fisheries of Ceylon are mentioned and this activity is also found associated with the Zanj Coast (Mozambique) in East Africa A mention is also made of the Islands of Langabalus (Nicobar Islands[5]) in connection with the possibility of cannibalism there

Mountains of Northern Area

On the northern frontiers of India Kashmir[6] is mentioned The Himavant (Himalaya) mountains are high and their peaks are covered with everlasting snow These chains of mountains stretch in the north and traverse the heart of Asia passing through Afghanistan, Kashmir, Tibet and China He added that the northern and eastern mountains of India in reality form one and the same system extending towards the east and then swerving south until they reach the Indian Ocean The Himalaya, he said formed a water parting between north and south

1 Vol I, p 197

2 Elliot (Vol I, p 378) identified it with the site of modern Karachi Various authorities have suggested other locations nearby about 35 miles north of Karachi The recent excavations near Bhambore tempted scholars towards this identification But as yet there is no finality in this respect

According to Balādhurī in Futuḥ al-Buldān, Daibal was situated on a small bay west of the mouth of the Mehran (Indus) This was the port which was captured by Muhammad Ibn Qāsim al-Thaqafi It was then a prosperous city engaged in commerce and trade

3 Modern names of places, natural features and areas are given in parenthesis

4 Vol 1, pp 280-81

5 Ibid,, p 417

6 Ibid,, pp 275-76

Al-Bīrūnī quoting Bhuvansakosa[1] said that the inhabitable world stretched from the Himavant Mountains (Himalaya) toward south into Bharatvarsha (Northern India) According to him the mythical Mount Meru the top of the world, was situated north of the Himalaya

The Great Plain

South of the Himalaya lay the vast plain of India which was surrounded by mountains on the north, east and west The drainage from the mountains flowed down to it Al-Bīrūnī discussed the origin and the nature of this plain and provided an excellent geomorphological description He said the plain was made up of fine sediment brought from the mountains There were large boulders and bigger, rounded and water-rolled pebbles close to the slopes of the highlands But at greater distance from the mountains where the streams flow more slowly, stones appear pulverised in the shape of sand and silt and the streams begin to stagnate near their mouths close to the sea He suggested that the Indian Plain had once been a sea which was slowly filled up by the alluvium of the streams

Rivers of India

Al-Bīrūnī devotes almost a whole chapter of the book to the rivers The sources of the rivers, their courses and characteristics were mentioned in some detail He also acknowledged the eminent Hindu sources of information on rivers and their mythological background The main rivers of India either rise in the northern, or eastern mountains, and join the ocean to the south He tabulated the names of leading rivers and areas which they traversed[4]

First, he mentions a large number of rivers rising in the various knots of mountains as mentioned in the Vayu-Purana They include such names as Godavari, Bhimarathi (Bhima), Kistana (Krishna), Tapi (Tapti), Durga, Nanda, etc After this another table is given with names of many more rivers such as Karatoya The river Sindh or Mehran (Indus) rises in the mountains of Unang in the territory of the Turks, which can be reached via Kashmir and Gilgit He also calls it the river Vaihand The river Biyatta, known as Jailam (Jhelum) from the city of this name on its western banks and the river Candarah (Chenab) join each other nearly 50 miles above Jahravar and pass along west of Multan The river Biyah (Bias) flows east of Multan and afterwards joins the Biyatta and Candarah The Ivara (Ravi) is joined by the Kaj which rises in Nagarkot in the mountains of Bhatul, and thereafter flows the fifth river of the Punjab Shatladar (Sutlej)

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1 An ancient geographical work of the Hindus
2 Vol 1 pp 264-65
3 Vol I, Chap XXV
4 Ibid, pp 347-48

He goes on to say that after these five rivers have joined below Multan at a place called Pancanda (Panchnad), i e the meeting place of five rivers, they form an enormous water-course In flood time it swells to such a degree as to cover a space nearly 10 'farsakhs' about 37 miles (in extraordinary floods as it happened in 1973) and to rise above the trees of the plains, so that afterwards the rubbish carried by the floods is found in their highest branches like birds' nests This bears a close resemblance to the great floods of 1973 The Muslims called the river by the name of Mehran after it had passed the Sindhi city of Aror as a united stream He added that flowing straight on, the Mehran became broader and broader, gaining in purity of water, enclosing in its course places like islands, until it reached al-Manṣūrah situated between several of its arms and flowed into the ocean at two places near the city of Loharani (near Karachi) and more eastwards in the province of Katch at a place called Sindhu-Sagara (Sind-Sagar)

The river Sarasti (Saraswati) falls into the sea at the distance of a bowshot east of Somnath In connection with the Ganges and its numerous tributaries, al-Bīrūnī mentions the Hindu belief that originally the river flowed in Paradise and quoting the 'Matsaya Purana', the writer goes on to say, that after the Ganges had settled on earth it divided itself into seven arms, the middle of which is the main stream known as the Ganges [2] The river Jamn (Jamna) joins the Ganges below Kanoj which lies west of it The united stream falls into the great ocean near Ganga-Sagara In another place, it is said that at the junction of the two rivers, Yamuna (Jamna) and Ganga (Ganges) there is a great tree called prayaga, a tree of the species 'Vata'

Between the mouths of Sarasti and the Ganges is mentioned the mouth of the river Narmada, which descends from the eastern mountains, takes its course in a south-western direction and falls into the sea near the town of Bharoj (Broach) nearly 60 'yojana' about 120 miles[3] east of Somnath

Seasons and Climate

Speaking of seasons he said that generally the common people believed in two seasons in the year namely, summer and winter According to the four divisions of the ecliptic which the sun traverses, the year can be divided into four seasons i e Spring, Summer, Autumn and Winter Al-Bīrūnī remarks that the Hindus divided the year into six parts and called these 'ritu' and each 'ritu' consisted of two solar months There was also a broad triple division namely, summer (grishma) followed by a rainy season (varshakala-commencing in June-July) and finally, winter (Sitakala) Twelve Indian months are mentioned by

1 Vol 1, p 262

2 Ibid, p 170

1 According to al-Bīrūnī (Vol I, p 167) one 'Yojana' was equal to 8 Arabic miles or = 32,000 yards and one 'Kroh = ¼ 'Yojana'

al-Bīrūnī (Chaitra, Vaishakha, Jyastha, Ashadha, Sravana, Bhadrapada, Asvayuja, Karttika, Margashirsha, Pausha, Magha and Phalgun)[1]

Al-Bīrūnī noticed the peculiarities of the Indian monsoon, the time of its breaking and described its westward and northward progress, unequal distribution of rain and occurrence of rain-shadows in the northern mountain region There was more rain in the central and eastern part of the Gangetic plain and much less precipitation occurred in West Punjab and the north west of the Sub-Continent He mentioned the snowfalls in Kashmir and the winter and spring rains in Kashmir and the plains to the south

Itineraries and Distances

When al-Bīrūnī came to live in India, Sulṭān Mahmūd's famous seventeen invasions had already taken place Though regular communications were in a mess, yet he has been able to point out more frequented itineraries The problem of distances was a ticklish one as the Indian measure was 'yojana' and al-Bīrūnī took cognisance[2] of 'farsakh' Sachau has suggested that since one yojana was considered equal to 8 Arabic miles (or 32,000 yards), one 'farsakh' could be equal to about 3 miles It appears that al-Bīrūnī's information on routes and roads was derived from military sources, traders and merchants, pilgrims, sailors and travellers He seems to have checked the information fairly carefully The important nodal points mentioned by him are Kanoj, Allahabad, Banaras, Meerut, Mathura, Bazana, Ujjain, Dhar, Pattan, Thana, Lahore, Multan, Peshawar, Almansūrah, Loharani and Tiz

Besides centres of communication, al-Bīrūnī speaks of many towns as centres of commerce, pilgrimage, religion and learning He had personally visited some of these cities A detailed mentioned of these towns and their activities is found in different parts of his book

Regions and Areas

Al-Bīrūnī provides some interesting details of the geographical aspects and life of distant areas in the Sub-Continent He seems to have a particular liking for Kashmir where he may have spent sometime He brings out its scenic mountainous nature, the interesting course of the river Jhelum, concentration of population in the vale of Kashmir, and the peace and calm of nature favouring learning and meditation From traveller's accounts he also pieced together information about Nepal, Bhutan and Tibet noting their inaccessibility, remoteness, life in the hills, and importance of human and animal transportation He said these areas formed a barrier between India and China

1 Vol I pp 283-84
2 Vol II, p 276 et seq

From Kitāb al-Hind and other related sources it appears that al-Bīrūnī acquired a good knowledge of many geographical aspects of India He keenly observed facts and intelligently speculated on them He had a special flavour for interpreting Hindu sociology and their scientific learning

On Size, Shape and Movements of the Earth

Al-Bīrūnī has examined in some detail[1] in Kitāb al-Hind questions connected with the earth, its shape, size and movements He gives a summary of Hindu ideas in this respect and then adds his own comments on them He asserted that according to Hindu astronomers[2] the heaven as well as the whole world is round and the earth has a globular shape, the northern half being dry land the southern half being covered with water The dimension of the earth is larger according to the Hindus than it is according to the Greeks The earth was in the centre[3] of the universe He had used Pulisa's "Siddhanta" and also makes references to the works of Varahamihira, Aryabhata and Vishnucandra, Brahmagupta and others to establish the rotundity of the earth The earth was fastened on the two poles and held by the axis The phenomena of day and night as well as the differences in time in east and west are due to the rotundity of the earth and the apparent movement of the sun Al-Bīrūnī discussed the question of the movement of the earth both in terms of rotation and revolution, but he could not make up his mind Many astronomical ideas and knowledge related to mathematical geography is discussed in his great book Canon Masudicus (al-Qānūn al-Mas'ūdī) written shortly after Kitāb al-Hind

In al-Bīrunī's time the debate was still raging about the notion of the movement of the earth around the sun or on the contrary the movement of the sun itself It appears that al-Bīrūnī was somewhat uncertain of his own ideas on the subject and said that either movement would produce the same result astronomically and then added that he had more fully discussed these ideas in his book[4] 'Key to Astronomy Miftāḥ 'Ilm al-Hai'ah (مفتاح علم هيئة)

Latitudes and Longitudes of some places

Al-Bīrūnī discussed at some length the Indian methods of measuring and finding latitudes and determining longitudes by the Hindu astronomers After some criticism of the methods adopted he pointed out that the chief meridian adopted by the Indians passed through Lanka (Ceylon), Ujjain, fortress of Rohitaka, the river Jamna, the plain of Thaneswar, and the cold mountains (Mt Meru) and that the meridian divided the world into two halves

1 Vol I, Chap XXXVI
2 Vol I, p 356
3 Vol I, p 358
4 Vol I, p 373

Then he went on to say that he had himself observed a number of latitudes and listed some as follows

Ghaznah (33° 35′), Kabul (33° 47′), Peshawar (34° 44′), Waihand (34° 30′), Jhelum (33° 20′), Fortress of Nandana (32° 0′), Sialkot (32° 58′), and Multan (29° 40′)

He added that if the latitudes of places are known, and the distances between them have been measured, the difference between their longitudes may also be found

He devised a new method of finding the Qiblah (Ka'bah) Al-Bīrūnī made certain calculations concerning the diameter of the earth and a degree of latitude by conducting measurements in the Tilla Balanath[1] areas of the present district of Jhelum in the Punjab The measurements were made on the principles enunciated in Ma'mūn's time But al-Bīrūnī's final comment was that the instruments used were too small and inadequate and he accepted the value given by Habsh Ibn al-Hāsib namely, 56 miles Al-Bīrūnī was fully conversant with the use of an improved type of uṣṭarlāb (astrolabe) in his experiments

In some of his work related to geographical information in connection with the discussion of minerals and metals given in his books like al-Ṣaydanah and Kitāb al-Jamāhir fī Ma'arifah al-Jawāhir (Book of minerals and precious stones) al-Bīrūnī expounds his geographical acumen

He has also tried to explain the origin of the artesian wells and the principles of hydrostatics involved in it Al-Bīrūnī was among the foremost scholars, scientists and intellectuals of the world His liberal ideas, wide scholarly horizons, painstaking researches, critical approach and objective outlook were unmatched by other scholars With his depth of understanding and unbiased outlook he sounds like a celebrated modern scientist He believed that the Arabic language in his time had become the vehicle of thought and was the only language in which scientific and literary contributions could be made But he had mastered several other languages including Persian, Sanskrit, Greek, Syriac and Hebrew Among his specialisms of knowledge was geography, geomorphology, geology, mineralogy, biology, astronomy, mathematics, archaeology and history He knew about most of the great Muslim intellectuals of his time and entered into discourse with some of them including Abū 'Alī Sīnā (Ibn Sīnā)

A few generations later, Yāqūt Ḥamavī gave two examples of al-Bīrūnī's love of knowledge and erudition which signify his intellectual status Yāqūt

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1 Encyclopaedia of Islam, (Urdu Edn), Lahore, 1971, Vol V, p 266

says he found in the library of the university at Marw sixty closely written pages listing the works of al-Bīrūnī *In another place he said that* al-Bīrūnī always held a pen in his hand and constantly read books and his mind was occupied in sorting out problems [1]

According to an estimate,[2] the number of his books and monographs exceed 190 and more are being discovered One of his great books on medicine (al-Ṣaydanah) was written when he had passed the age of 77 There are only a few examples of such monumental scholarship in the world as demonstrated by al-Bīrūnī

1 Encyclopaedia of Islam (Urdu Edn), Lahore, 1971, pp 263-64

2 Ibid , pp 267-68

ABŪ RAIHĀN MUHAMMAD IBN AHMAD AL-BĪRŪNĪ

(973 *A D* — 1048 *A D*)

A Restless Genius in Search of Knowledge

G ALLANA

A man is born, he lives for a while, and finally he dies He comes to be buried or is burnt With him come to be buried his name and his memory He becomes one with yesterday's million years, entombed in the dark limbo of oblivion But there are some, who are born, they live for a while, they die, they also come to be buried or are burnt But their life and work continue to speak eloquently in the pages of man's pilgrimage to civilisation, culture, knowledge and wisdom Their memory is perfumed with the fragrance of eternal spring These are the immortal ones of history, who have left everlasting footsteps on the sands of time The echoes of what they said continue to rise from beyond their graves, and to continue to act as a guide for countless generations

One such person was that genius of many facets, Abū Raihān Muhammad Ibn Ahmad al-Bīrūnī, whose Millenary we have gathered here to celebrate The claws of time have not gnawed his image In spite of the lapse of thousand years, he startles the imagination of our scholars as an immortal genius, just as he dazzled his contemporaries with the brilliance of his erudition and wisdom Empires and civilisations are like the flash of a glow-worm in the eyes of Time, while history bestows upon great men the crown of immortality And al-Bīrūnī is a man of outstanding genius, who by his contribution in many fields of learning, has carved out for himself an abiding place among the most learned luminaries of all time

Although it is very difficult to be precise about the birth date of people born at that period of antiquity, yet we have it on the authority of some scholars that he was born on 3rd of Dhū al-Hijjah 362 A H which is equivalent to 4th September 973 A D The question arises where was al-Bīrūnī born? Different sources have indicated different birth places For instance, Shahrazūrī, one of his

earliest biographers writes in his book, "Tawārīkh-i-Ḥukmā" that "al-Bīrūnī was born in a town called Bīrūn, which was in Sind a beautiful town It has many excellent and wonderful things to offer" This statement finds support in the writings of some scholars, particularly in the writings of Hājī Khalīfah and 'Abd al-Fidā But the questron is where was the city of Bīrūn located in Sind? No authentic historical or archaeological record has been found to identify it on the maps of ancient Sind This offers a fruitful field to Pakistani historians and archaeologists Until they strike some authentic evidence, the fact of his having been born in Sind will remain in the shadowland of doubt and uncertainty Nonetheless, Varahamihira offers Bīrūn as one possibility of the birth place (Article appearing in Hindustan Times of 4th May, 1973)

Soviet scholars, delving deep into the entrails of bygone centuries, have come out with the conclusion that al-Bīrūnī was born at Khiva in Uzbekistan It is said that preparations are afoot in the Soviet Union to produce a full length film on al-Bīrūnī, spotlighting Khiva in the USSR as the birth place of that great genius There is yet another authority who maintains that he was born in Khwārizm in Central Asia Whatever be the place of his birth, it would be historically correct to say that he did not languish in poverty while he lived In contrast to his life and history, it is said of that Greek poet, Homer, that while he lived, no city was prepared to show any favours to him, being disclaimed by all of them But when he died and his name passed into the ranks of the immortals, many cities vied with each other in claiming Homer to be her own citizen So it came to be said

> Seven cities contend for Homer dead,
> Through whose streets Homer begged for bread

What sort of a man was al-Bīrūnī ? He can be best compared to a brilliant diamond of many dazzling facets The flame of his genius illumined man's path on his pilgrimage to the shrines of many temples of learning To him goes the credit of propounding original revolutionary theories of far-reaching importance in branches of learning as diverse as Medicine and Astronomy, Mathematics and Chronology, Physics and History, Anthropology and Religion, Geography and Natural Science, Astrology and Meteorology, History and Sun Clocks, Ethics and Geology, Medicine and Poetry To this unbelievable list must be added his long and tireless tracks that took him across many cities and countries of the ancient world To each of these sciences, he has made a contribution that is truly great and abiding He was born in 973 A D, and died in 1048 A D Out of these seventy-five years, if one were to deduct fifteen years of childhood, it can be safely summed up that whatever he achieved was during the span of sixty years Considering this, the human mind is staggered, when one recalls that he mastered many branches of learning and wrote about 120 books Out of these, according to Dr B Nasim of the Peshawar University, eighteen are on Geometry

and Astronomy, fifteen on Geography, eight on Mathematics, four on Light, five on the Astrolabe, five on the Seasons of the Year, five on the Comets, twelve on the Stations of the Moon, seven on Astrology, thirteen of them contain tales and stories, six on Religion, about twenty are unfinished books Of the latter the author did not retain a copy It is appropriate to call him a restless genius, who spent his whole life, tirelessly in search of knowledge In his endless wanderings on the highways of learning up to the last days of life, he reminds one of what Buddha said to his favourite disciple, Ananda, as his final advice, before he breathed his last "Ananda Seek, Seek without wearying" In another context, Shāh 'Abdul Latīf says that if you wish to seek God, then do not sit down or rest Seek him Seek him

A free translation of the Sindhi couplet is

Whether it be sunshine or rain,
From Seeking Him do not refrain

And al-Bīrūnī spent his days and nights without tiring, in search of knowledge, enabling him to come into possession of that key which opens the lock and gives one entrance to the magnificent mansion of Wisdom

It is worth mentioning that the life and period of al-Bīrūnī sparkled with a galaxy of brilliant men of letters and learning in the world of Islam While al-Bīrūnī was watching the wanderings of the stars on the highways of the skies and recording the conclusions of his calculations, Firdawsī (973 AD - 1020 A D), born in the province of Khurāsān in Persia, was soaring high on the wings of fancy and singing his epics that have deathless charm about them As al-Bīrūnī busied himself making new discoveries in the uncharted field of geography, Hakīm Abū 'Alī Sīnā (980 A D - 1037 A D), born at Aphona the province of Bokhārā, was making inroads into the hitherto un-penetrated paths that lead to the gate of philosophy At the same time that al-Bīrūnī delved deep into the planetary positions of the heavenly bodies and opened many windows on the store-house of the science of astrology, Ibn al-Haitham (965 A D - 1039 A D) recorded his penetrating and minute observations, thereby enriching greatly the science of optics While by toil, sweat and tears, al-Bīrūnī was untying many difficult knots around the feet of the science of mathematics, Abū al-'Alā al-Ma'ārī (937 A D - 1057 A D), born of Spanish descent near Aleppo in Syria, was lost in silence on the tranquil shores of Meditation, his writings giving a new depth to mysticism As the footsteps of al-Bīrūnī trekked across cities and countries, there was another Abū al-Ṭaiyib al-Tabarī who was born at Amul and died in Baghdad (960 A D - 1058 A D), sank deeper and deeper within himself and drew up as a thinker from the ocean of thought many pearls of wisdom The echoes of the march of al-Bīrūnī across many frontiers were caught up with the echoes of the constant trek of Hakīm Nāṣir Khusraw (1003 A D -

1060 A D), who was born in Balkh and died in Badakhshān, while doing active missionary work, propagating the Faith of Islam in Central Asia Hakīm Nāṣir Khusraw and al-Bīrūnī appear to have been at the same time in the Indo-Pakistan Sub-Continent But it is not recorded for posterity, if the two great men ever met during their sojourn here The pen of al-Bīrūnī raced across, leaving behind a luminous path of immortal writing just when the oratory of al-Mu'aiyad fī al-Dīn al-Shirāzī (999 A D - 1065 A D), born in Shiraz as his name implies, was swaying vast multitudes of men by the seeping power of his eloquence whilst princes and statesmen eagerly sought the advice of al-Bīrūnī on matters of state, there lived another world renowned statesman in the Islamic world, Nizām al-Mulk (1017 A D - 1091 A D), born at Ṭūs in Khurāsān, who is famous in history as a legendary statesman of these days, on whose advice the Seljūq Sulṭāns heavily leaned One of the most outstanding names of al-Bīrūnī's times was the Fāṭimid Caliph, al-Mustanṣir (1029 A D - 1094 A D), who was then in Cairo, and in whose reign Fāṭimid Caliphate rose to great heights of glorious achievement While al-Bīrūnī travelled in what is now Pakistan, there lived in Lahore the great Ṣūfī saint, Dātā Ganj Bakhsh (1009 A D - 1088 A D) In the absence of any historic evidence, it is not possible to say whether al-Bīrūnī, master of science and literature, was at any time in the presence of Dātā Ganj Bakhsh, who was a master in the domain of religious thought

Bīrūnī in the Persian language would be equivalent to the English word "The Outsider" The question is why has this epithet survived ten centuries and has become so interlinked with his real name, which was Abū Raihān Muhammad Ibn Ahmad Two possible answers have been suggested in answer to this query The first, that al-Bīrūnī travelled so much and such a great part of his life, that he was most of the time away from his native city, and therefore, an outsider The second possible explanation is that he is said to have had a house outside the city of Khwārizm, on its very outskirts Thus, he came to be called al-Bīrūnī, " The Outsider" Often travelling, restless, gathering the fruits of accumulated human knowledge, he reminds one of what that great poet Homer said about that famous traveller of antiquity in Odyssey

For, always roaming with a hungry heart,
Much have I seen and known

Even the exact location of his burial place is shrouded in a maze of doubt and uncertitude However, some authors maintain that he was buried in Ghaznah But, Dr Latīf Minhās writes, "There is no trace of his last resting place "

He is said to have been a self-taught man, with a prodigious tenacity for learning The fact that he often quotes from the Holy Qur'ān would lead one to believe that he must have been a religious-minded person But he reveals in his writings that faith should not be allowed to act as a hurdle in one's pursuit for knowledge and one's search for Truth He was prepared to bend his knee in

reverence, wherever he could enrich his knowledge His remarkable mastery in many fields of science and literature was matched by his fabulous proficiency in learning languages He was quite at home in Arabic, Persian, Turkish, Hebrew, Sambani and Sanskrit His profound erudition and tolerant attitude towards those differing from his views have won for him the admiration of Western scholars like Dr Edward C Sachau, De Boer, Carra de Vaux, Nallino, Raymond Beazlay and others

There are many reasons why al-Bīrūnī has won handsome praise from such Western scholars He does not get lost in the jungle of unnecessary details, but keeps his steps hitched to the path of the seeker after Truth While unfolding a philosophical problem in all its intricate diversities, he refrains from being dogmatic about the answer to the problem under discussion, but would rather see that his disciples applied their own minds to the problem and come to their own conclusions His objective assessment of contemporary problems and philosophical controversies, his penetrating mind, keeping steadfast on the path of scientific impartiality, prevented his writings from being interjected with the venom and prejudice of bias and partisanship

His famous book Qānūn al-Mas'ūdī (Canon Masudicus) is a magnificent compendium on such subjects as eclipses of the sun and moon, storms and cyclones, cosmology, rain and draught, waterfalls and the science of measuring the depth of the rivers and the oceans Galileo and Newton, in the seventeenth century, astounded the world by what they wrote about the earth and the theory of gravity But the foundation of what they wrote had been laid seven hundred years earlier by al-Bīrūnī If his writings are judged in the proper perspective of history, keeping in mind his precedence in time-dimension over Western scientists, al-Bīrūnī's stature assumes the proportions of a colossus on the stage of human learning The world pays tributes to Galileo for the invention of the telescope But it would be an error in the realm of impartiality to close one's eyes to the fact that Galileo's telescope was merely an improved version of al-Bīrūnī's famous Uṣṭarlāb, which was identically an instrument for calculating the movement of the celestial bodies

Before coming to India, he had deeply studied the origin and development of Greek thought and philosophy Being a true Muslim, he was attuned to the spirit of Islam in its pristine purity Having come to India, he delved deep into the ocean of Hindu philosophy, shorn of outward ceremonialism that sometimes crippled the true spirit of the teachings of the ancient Hindu thinkers His discerning mind saw a common thread running through the beads of the rosary of world's great religions, Hindusim, Christianity and Islam His comprehension led him to believe that there was a great deal of similarity and identity of views in the teachings of the ancient Hindu religious leaders, and the Christian mystics and other Muslim Ṣūfīs Varahamihira writes that al-Bīrūnī is reported to have said, "I have translated into Arabic two Indian works, one discusses

the origin and quality of things which exist, and is entitled Sankhya, the other is known under the title of Patanjali, which treats of the deliverance of the soul from the trammels of the body" Al-Bīrūnī mentions in his famous book *Kitāb al-Hind* that in spite of the fact that he was a friend and counsel of Sulṭān Maḥmūd of Ghaznah, he was looked upon as an untouchable by the Hindus He records faithfully what he saw in India, namely that the Indians plastered their walls with cow-dung in order to purify their homes, and some annointed their foreheads with the urine of the cow in observance of a religious rite He shows no bitterness or animosity either to the Hindus or to their religion, in spite of the fact that he was looked down upon, as he was not a Hindu

There are different versions as to how al-Bīrūnī came to India Some maintain that he came to India with Sulṭān Maḥmūd of Ghaznah when he invaded India, at whose court he had at first come as official in the embassy of the Sulṭān of Khwārizm in Ghaznah, and then he came as counsellor to Sulṭān Maḥmūd himself While, according to others, the rich province of Khwārizm attracted the attention of Sulṭān Maḥmūd, who invaded it and annexed it to his territories in 1017 On the fall of Khwārizm, Professor Muḥammad Habīb of Aligarh University writes, "Al-Bīrūnī was sent to India as a political prisoner, along with Khwārizmian princes, to whose interests he (al-Bīrūnī) had adhered" It is difficult to say with any certainty as to how long he stayed on the Indo-Pakistan Sub-Continent But it is recorded that his stay was anywhere between ten and forty years While the length of his stay may be a matter of dispute, what is beyond challenge is the fact that his stay on the Sub-Continent was by far and large confined to what is now known as Pakistan There is no detailed record to reconstruct the history of his travels on the Sub-Continent, from which one could pinpoint on the map the routes he took and the journeys that he undertook during his long sojourn in this part of the world

It was his master, Abū Sahl 'Abd al-Mun'im ibn 'Alī ibn Nūḥ al-Tiflisī, who suggested to him the idea of writing a book on the Hindus of India, which he completed between 1017 A D and 1031 A D This is the book that posterity has come to know as *Kitāb al-Hind* Abū Sahl had suggested to al-Bīrūnī to write a book that would help those who want to discuss religious questions with the Hindus In compiling this book, al-Bīrūnī wrote, "I have written this book on the doctrine of Hindus, never making an unfounded imputation against those - our religious antagonists - and at the same time not considering it inconsistent with my duties as a Muslim to quote their words at full length, when I thought they would contribute to elucidate a subject This book is not a polemic one My book is nothing but a simple historical record of facts I shall place before the reader the theories of Hindus exactly as they are, and I shall mention in connection with them similar theories of the Greeks in order to show the relation between them "

He confesses that he was fortunate that his circumstances were such that

enabled him to travel much and to meet and discuss various subjects with the Hindu scholars of India at that time, and also that his pecuniary circumstances were affluent enough to enable him to purchase books, in order to pursue his studies in many fields of Indian studies For, he writes, "This is the state of affairs in India It is difficult to fully comprehend the subject, although I would greatly like to do so, and this in spite of the fact that I have devoted both time and money to collecting books in Sanskrit from different places, including very remote parts I even conversed and discussed with Hindu scholars in order to understand I ask, which other student could have had better opportunities than myself to study the subject   Thanks be to God for what He has graciously bestowed upon me, which I consider as sufficient for the objective I have in view   "

Al-Bīrūnī makes some original and thought-provoking observations regarding the Hindus of the time He writes, "On the whole, there is very little disputing about the theological topics among the Hindus At the most they fight with words, but they will never stake their life or their body or their property for religious controversy   Folly is an illness of which there is no medicine The Hindus believe that there is no country like theirs, kings like theirs, no nation like theirs, no religion like theirs They are haughty, foolishly vain, self-conceited, stolid They are by nature niggardly in communicating that which they know According to their belief, there is no other country in the world but theirs, no other race of men but theirs, and no created beings besides them have any knowledge or science whatsoever   "

Al-Bīrūnī records in *Kitāb al-Hind* that when he first came to India and met Hindu scholars, they looked upon him with airs of superiority complex After all, they thought al-Bīrūnī was a stranger, from a foreign land, and not from the ancient land of India, hoary with wisdom Let al-Bīrūnī express this himself He writes, "At first I stood to the Hindu astronomers in the relation of pupil to his master, being a stranger to them   On having made some progress, I began to show them the elements on which the science rests, to point out to them some rules of logical deduction and the scientific method of all mathematics and then they flocked around me from all parts, wondering and most eager to learn from me, asking me at the same time from what Hindu master I had learnt those things, whilst in reality I showed them what they were worth, and thought myself a good deal superior to them, disdaining to be on level with them   They spoke of me as the "sea", or as "the water" which is so acid that vinegar in comparison is sweet "

His book is studded with quotations from the Holy Qur'ān, as is evident from what he writes about a moral precept "That man is only praiseworthy, who shrinks from a lie and always adheres to Truth, enjoying credit even among liars, not to mention others " It has been said in the Holy Qur'ān, "Speak the Truth, even if it is against yourself". And the Messiah confesses himself in the

Gospel to this effect, "Do not mind the fury of the kings in speaking the Truth before them They only possess your body But they have no power over your soul " He believed in order that scientific knowledge should triumph, one must boldly assault the protected citadel of superstition One must open wide the gates, one must build the bridge, so that the armies of scholars could emerge from the dungeon of servitude, and triumphantly go marching all over the world, with the lamp of knowledge in their hands Reverting back to the insular attitude of the Hindu mind, he writes, "I can only compare their (Hindus) mathematical and astronomical literature, as far as I know it, to a mixture of pearl shells and sour dates, or of pearls and dung, or of costly crystal and common pebbles Both kinds of things are equal in their eyes, since they cannot raise themselves to the methods of strictly scientific deduction " With all this, no one can fail to discern throughout his book, al-Bīrūnī's strong inclination towards Hindu philosophy, which according to him was akin to that of the Greeks

The thinking of al-Bīrūnī was influenced in its formative stages by scholars of different religions For instance, among the Muslims, Manṣūr Khwārizmī had a profound influence in awakening his mind venture forth in the pursuit of knowledge, Abū Sahl Masīḥī, a Christian, opened for him the doors that gave him an insight into Christian mysticism, and the Hindu scholar, Dur Lāb, guided his steps while finding his way in pastures beset with the intricacies of Hindu philosophy His mind was like an ocean ready to receive waters flowing into it from all rivers, whatever their source The ocean does not question the rushing waters as to their origin But the identity of the two becomes unified and all talk of duality ceases Thus al-Bīrūnī was enabled to arrive at his own synthesis, in spite of his deep studies in the store-houses of these three religions, which to the less initiated bristled with contradictions and anti-thesis And so, al-Bīrūnī writes, "I shall place before the reader the theories of the Hindus exactly as they are, and I shall mention in connection with them similar theories of the Greeks, in order to show the relation between them Besides Greek ideas, we shall only mention now and then those of the Ṣūfīs (Muslims) or of some other Christian sect, because in their notions regarding the transmigration of souls and the pantheistic doctrine of the unity of God within the Creation, there is much in common between these systems" Pointing out certain degrading religious customs and ceremonies in Hindu society of the time, he observes, "Of a truth, it is God Himself, who has not permitted His Divine Attributes to be attached to a false religion But some will say that the inequities, which have roused indignation are due far more to the vicious conditions of civilisation, than to perversity of religious principles But I may reply, what is the object of true religion, if it is not to correct such vices?" Bearing in mind that Hindus believed this world to be *maya*, or a mirage, his mind kept probing about Ultimate Reality So at another place, al-Bīrūnī writes, "There are people, who believe that it is only the First Cause that has any real existence The Ṣūfī (Muslim) also believes the same Ṣūfī means the sage, and in Greek Sophia means wisdom."

We have an interesting anecdote about al-Bīrūnī's mastery in astrology, as related by Nizāmī 'Aradī Samarqandī in his book, *Chahār Maqālah* He relates that once Yamīn al-Dawlah Sulṭān Maḥmūd Ibn Naṣīr al-Dīn Subuktigīn was sitting on the top of a roof of a house in Ghaznah, and that house had four doors The Sulṭān asked al-Bīrūnī to take the aid of his knowledge of astrology and to correctly predict by which of the four doors the Sulṭān would make his exit Al-Bīrūnī called for an astrolabe, made his calculations, put his prediction on a piece of a paper, and placed it under the pillow of the Sulṭān Maḥmūd was crafty He ordered his men to dig out an improvised fifth door and made his exit through that door When the Sulṭān, thereafter, took up the piece of paper on which al-Bīrūnī had written out his prediction, it turned out to be precisely what the Sulṭān had done

But Sulṭān Maḥmūd was not to be outwitted He ordered al-Bīrūnī to be thrown out of the palace window Al-Bīrūnī, by chance, happened to fall on a net that happened to be there, and then softly fell on the ground, safe, unshaken, smiling The Sulṭān yelled "But, Abū Raiḥān, you did not know of this!" Al-Bīrūnī replied that he had known it and as a proof asked that his almanac be brought Amongst the predictions of the day, it was written that al-Bīrūnī would be thrown from a great height, but that he would fall on the earth safely, unhurt !

Al-Bīrūnī travelled thousands of miles, tirelessly But to him they must have seemed less than a yard, as they had all been undertaken to enrich his mind and his erudition He was like a mighty waterfall For, from his copious pen gushed forth many streams of learning, only to be absorbed in the ocean of human wisdom for the enrichment of mankind

No one knows where al-Bīrūnī lies buried If this were known, there may have been over his mortal remains a magnificent mausoleum, or rich marble and alabaster, ornamented with decorations of breath-taking beauty There, scholars from many places would have flocked to place flowers at his feet But today, even after the lapse of a thousand years, he continues to have an honourable place in the hearts of men of learning in all parts of the world Today, the world places rich literary tributes, as flowers of deathless fragrance, in token of their humble tribute and homage to that restless genius, who spent his whole life in search of knowledge

AL-BĪRŪNĪ AND HIS ACADEMIC CONQUESTS*

GHULAM RABBANI AZIZ

THE author gives an environmental background of al-Bīrūnī from his birth onwards, the period of al-'Irāq in which he attained a vast degree of scholarship in a brief period, then his welcome in the courts of Shamsul Mo'ālī Qābūs Shah, followed by 'Alī bin Mā'mūn's period when he was greatly acknowledged by his vazir Abū al-Hasan Aḥmed bin Moḥammad al-Khwārizmī, then the period of Abu Al-'Abbās Mā'mūn and his association with Ibn Sīnā, Abū Sahl Masīḥī, Abū al-Khair Khammār and Abū Naṣr Manṣūr, After Mā'mūn's assassination Sulṭān Maḥmud of Ghaznah who was Ma'mūn's brother-in-law attacked Khwārizm and annexed it to his kingdom when al-Bīrūnī entered the courts of Maḥmūd, and accompanied him on his various expeditions to India, during which he studied the Sanskrit language and attained vast and intimate knowledge of the Hindu literature When he died at the age of 78 he left a vast treasure of knowledge in various fields of scholarship which he had conquered These included about 114 books and journals, in which 18 were on astronomy, 15 on geography, four on light rays and sight, five on astronomical instruments and their use, five on estimation and fixation of time, five on tailed stars, seven on astrology, 14 on light reading and humour, six on religious beliefs, and 22 books on miscellaneous subjects including astronomy, geography, universal phenomena, travel etc Five of his books were lost during life, after completion And strangely a large number of his original texts were destroyed by a despot in 13th century, Changez Khan, who was from Bīrūnī's own country We owe gratitude to Professor Sachau who sought out the manuscripts of Kitāb al-Hind and Qānūn Mas'ūdī and got them translated in German Kitāb al-Hind has now been translated in Urdu language also

Some noteworthy contributions of al-Bīrūnī are

1 Trisection of an angle, and solution of some complex problems without the use of protractors and scale

2 Accurate determination of latitude and longitude of a large number of places

*Original paper is in Urdu ,This is an English abstract of the paper

3 Pointing to the existence of the American continent

4 Putting forward his theory that the Sind valley was under water at some time in the past, which later changed into dry land following some geographic changes

5 Explaining the flow of springs on the principle that water finds its own level

6 Determination of specific gravity of 18 precious stones and metals

7 Providing proof that light travels at a much faster speed than sound

8 Explaining the forces of gravity

9 Throwing light on gravitation force

10 Devising methods to identify a number of precious stones

11 Explaining the phenomenon of fire visible at the time of sun eclipses

12 Providing useful information and views about the height of various trees

13 Discussion on the issue whether the earth revolves round its axis or not

14 Explaining on the universal law of nature that flowers have always 3, 4, 5, 6, or 8 petals and never 7 or 9

15 Determination of the circumference and diameter of the earth by using spherical trigonometry

16 Determination of sun's declination and zenithal movement

THE STATIONS OF AL-BĪRŪNĪ ON THE JOURNEY FROM GHAZNAH TO PESHAWAR

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THE privilege of saluting the achievements of Abū Raihān Muhammad ibn Aḥmad al-Bīrūnī is one that is eagerly welcomed by the informed scientist and scholar in every branch of learning Celebrated above all as astronomer and mathematician, the sage whom we honour on this occasion stands, as the earlier papers of this Congress will have amply shown, in the topmost rank amongst the scientists of mediaeval Islam and indeed of all ages A keen and critical observer of natural phenomena, he was at the same time ready, in the humane tradition of his day, to extend his interest to the whole body of available knowledge Everywhere he shows an objectivity and clarity of judgement such as even our technological century can justly envy His standing as a truthful and perceptive witness will be evident to the careful reader at every turn His researches amongst the stars are indeed widely famed Yet he devoted perhaps his most remarkable treatise to the mineral treasures of the earth, and moreover in his latest book, he explored the medicinal virtues of the vegetable kingdom At the same time it should not be forgotten that Abū Raiḥān possessed outstanding talents as a historian, and indeed took a lively interest in the evidence for the human past offered by archaeological remains His early work, *al-Āthār al-bāqiyah* (well known in English under the title 'The Chronology of Ancient Nations') provides extensive material of fundamental value to the historian, and the same can be said of his treatise on India and Indian astronomy, the *Kitāb mā-lī al-Hind*, which I shall be citing under its English title of the *Indica* The student of political events will constantly regret that his strictly historical works, the account of the sage's homeland contained in his *Kitāb al-musāmarah fī akhbār Khwārizm*, and the description of the heterodox sects contained in his *Kitāb fī akhbār al-Mubayyidah wal-Qarāmiṭah* have never been recovered For the purposes of the present paper the loss of his early Ghaznavid history, the *Ta'rīkh ayyām al-Sulṭān Mahmūd wa akhbār abīhī* leaves a special gap The rather patchy

and uneven coverage of the reign of Maḥmūd of Ghaznah provided by the other historical sources would have made doubly precious the evidence of so perceptive an eye-witness, and one moreover with an interest in recording unusual details It is worth noting, in the course of the present paper that several fragments of historical information to which our author's geographical discussions in the *Tahdīd* and the *Qānūn* indirectly allude are interestingly echoed by the anecdotes of Ghaznavid history contained in the text by Fakhr-i-Mudabbir, *Ādāb al-ḥarb wal-shajā'a* The possibility of a source relationship with the *Ta'rīkh ayyām al-Sulṭān* would be worth examining Yet even if no direct link should be established, there is no doubt that the narratives of Fakhr-i Mudabbir closely reflect the world of al-Bīrūnī's journeyings

The aim of the present paper is to examine, from the viewpoint of its archaeological interest, the topographical date for the district between Ghaznah and Peshawar contained in the Gazetteers of the *Qānūn* It is contained chiefly on Volume II, pp 561-2 and 573-4 of the printed edition We have tried to check the latitudes and longitudes given in this work for the various towns to see how far they agree with the values given elsewhere in the author's works (which they often do not), and to establish, when the sites are known, to what extent they agree with currently accepted values In the light of these results an attempt is made to apply al-Bīrūnī's co-ordinates for sites that are not yet identified, to ascertain how far these too may appear plausible, and what lead they may offer for future exploration

My interest in the verification of al-Bīrūnī's latitudes and longitudes in the neighbourhood of Ghaznah arose originally from a wish to identify the site of the historical township of Sakāvand This was a place that played a significant part during the advance of Islam towards the Indus plains The first mention of it which I have found is in an anecdote of al-'Awfī's *Jawāmi al-hikāyat* relating to an event of the Hijrah year 283 The Ṣaffārid prince 'Amr b Layth had sent as prefect to Ghaznah an officer named Fardaghān This official decided to launch a raid against Sakāvand, which lay in the nearby territory of the Kābulshāh The Shah reigning at this time was named Kamalūka He appears in the Persian narrative as Kamalū With a force of 4000 horsemen, Fardaghān entered his territory and succeeded in surprising Sakāvand, where there existed a wealthy temple containing images, and which was much frequented by pilgrims coming from the east Fardaghān captured the town, put its inhabitants to flight, and seized a rich booty Following normal Islamic military practice he dispatched a portion to 'Amr, his prince, and divided the residue with his men However, the Kābulshāh was naturally incensed at such a hostile act, and planned severe reprisals He gathered a powerful army, and prepared to advance upon Ghaznah The point of the anecdote then lies in the strategem by which Fardaghān persuaded the Kābulshāh to delay the completion of his plan He sent messengers to his overlord, 'Amr, who was threatened with difficulties of his own from the impending invasion of his territory near Balkh by Ismā'īl the Sāmānid, and asked

for large reinforcements to resist the attack The adventurous prefect need not have expected very effective help, in view of the military situation, but he also arran͜ged for a leakage of information to the Kābulshāh, to the effect that very large forces were on the way, and that the armies of Kābul were about to fall into a trap Understandably Kamalūka delayed his advance, and began to move with exaggerated caution Thus Fardaghān was able to hold out until at last a sufficient force arrived to enable him to beat off the attack

It was not until the establishment at Ghaznah of the House of Sabuktegin that Sakāvand is next mentioned in the historical narrative In the *Hudūd al-'Ālam*, a geographical worke completed in A H 372, Sakāvand is mentioned as a place possessing a strong fortress It appears, rather unexpectedly, in the *Garshāsp nāmah*, the fanciful reworking of the famous Zoroastrian legend composed in verse by the younger Asadī during his residence at Ghaznah The original form of this legend seems to has been popular in the Sīstān area, and its most spectacular episode was the slaying by the hero Garshasp of a monstrous dragon Yet it is hardly to the Zoroastrian tradition that Asadī owes the location of this combat at a spot so remote from Zoroastrian Iran as Sakāvand It is more likely that the mention of this locality was one of many touches of local colour appropriate to the lifetime of Maḥmūd of Ghaznah which Asadī has woven into the traditional story At the same time, his association of Sakāvand with a monstrous serpent is by no means as irrelevant one We learn from the memoirs of the Chinese Buddhist pilgrim Huan-Tsang, who visited the Kabul Valley shortly before the coming of Islam, that there were many legends current in the region concerning the Nāgās, those supernaturally endowed serpent-creatures of the Buddhist tradition, who are also prominently depicted in Gandhārā art It is a fact that cobras are not uncommon at the present day along the Kābul River and its tributaries, and their legendary role as the guardians of temple treasures is also still remembered, as I shall shortly show

Of all the early references to Sakāvand in Muslim literature, the most informative from the factual point of view is, characteristically the brief notice by al-Bīrūnī (*Qānūn*, II, 574) where the description occurs in the list of longitudes and latitudes

Qal'āt Sakāvand fī rustāq Lahūgar

'The fort of Sakāvand in the rural district of Logar' and this description is followed by the co-ordinates The specific localisation of the town in the broad valley of the Logar, immediately to the south of Kābul behind a line of hills, greatly narrowed the area of search, and led me to hope that it might be possible to identify the township upon the ground I decided to work out the co-ordinates in order to ascertain whether they would fix precisely the position of the site

The latitudes and longitudes quoted by al-Bīrūnī are specified according to

the *Abjad* system of numeration Their conversion to modern numerals is therefore simple With regard to their basis of calculation, that on which the latitudes are reckoned is the same as that used by geographers today Leaving aside possible errors of calculation, or discrepancies resulting from the fact that the great astronomer was working with very simple instruments, these are figures which can be directly transferred to the modern map. To convert his longitudes involves a slightly more elaborate calculation In ancient and mediaeval times, no certainty existed that the shape of the earth was spherical, and would therefore cover the complete circle of 360° Instead, the custom had become established of measuring eastwards by degrees from the Canary Islands, rather than as today from Greenwich or elsewhere However, for these regions far to the west of his own area of research, al-Bīrūnī was compelled to rely either on traditional figures going back to classical Greek times, or on the calculations of his mediaeval contemporaries It is true that in a number of his works, and especially in the *Tahdīd*, al-Bīrūnī exercised the greatest care in establishing the correct number of degrees of longitude lying to the west of his own centre at Ghaznah However, it will simplify matters considerably if I take no account of those problems at the present moment For as I have said, it is clear that when he compiled the tables of co-ordinates contained in the *Qānūn*, his base was at Ghaznah He had also indeed undertaken detailed calculations to fix the position of the town of Bust on the Helmand These researches were contained in his lost work, *Fī taqwīm al-qiblah bi-Bust bi-taṣḥīḥ ṭūlihā wa-ʻardhiā* (On the fixing of the direction of prayer at Bust by correcting its longitude and latitude), and the recovery of this work would certainly have been of the greatest interest for our present purpose Our author was, in fact, the first Muslim geographer to concern himself with places, systematically, to the east of Ghaznah and all the co-ordinates established by him for those areas are evidently derived either from his own observations (no doubt with those of assistants and informants), or from written sources checked and approved by him The point of departure for all these calculations is no doubt provided by the position of Ghaznah itself, which he had calculated with great care, as explained in the *Tahdīd* Thus for locating any more easterly site, it is reasonable to ignore any errors that may have existed in older surveys for regions further to the West, and concern ourselves simply with the difference between the longitude of Ghaznah, as reckoned by al-Bīrūnī, and that of the other localities The simplest way of reckoning this difference is to ascertain the difference between al-Bīrūnī's figure for the longitude of Ghaznah and that established at the present day When this difference is subtracted in turn from his figures for other stations, these also will be converted to compatibility with the modern map

In round figures, al-Bīrūnī's co-ordinates for Ghaznah are Long 94° 20′ East by Lat 33° 35′ North (*Qanun* II, 561) The calculations are worked out more precisely in the *Tahdīd*, where the longitude is shown as 94° 22′ 24″, but such theoretical precision confers no real advantage, since the procedures that lead up to it are admittedly rather approximate Modern authorities give the

longitude of Ghaznah as 68° 18′, and if this figure be subtracted from that of al-Bīrūnī, the difference is 26° 02′ In subsequent calculations this will be rounded off to 26°, since it is evident that the instruments in use at the time could not measure reliably a single minute of arc If then this difference of 26° is subtracted from the other longitudes given in the *Qānūn* in the region east of Ghaznah they should be reduced to the same basis as that used by modern geographers, and the cumulative errors resulting from the reckoning from the Canary Islands should be eliminated Any residual errors should result either from manuscript corruptions, or else from errors of observation at the particular localities, which we may subsequently hope to detect and explain

At this point it may be convenient to give a list of the sites which are to be discussed in this paper These are as follows

1	Ghaznah	8	Lāmghān
2	Sakāvand	9	Ribāṭ Kindī
3	Kābul	10	Fatḥābād
4	Jayfūr	11	Dunpūr
5	Parvān	12	Peshāwar
6	Bāmiyān	13	Karūr
7	Nejrāb	14	Farmul

I can now return to the localisation of Sakāvand, for which the co-ordinates given in the printed text of the *Qānūn* II, 574 are صرل اج م When the *abjad* numerals are converted to modern notation the result is 97° 30′ East by 33° 40′ North We have next to subtract 26° from the longitude, as already explained, to adjust it to the modern computation The result is 71° 30′ East by 33° 40′ North This location is evidently far to the East, and in the vicinity of Peshāwar, and *definitely not within the confines of the Logar Valley* It is therefore obvious that the figures in the printed text are faulty here, but to amend them conjecturally would be dangerous I had, therefore, run up against a difficulty at this point, when fortunate circumstances led to a solution

During 1969 I spent the summer at Kābul, and happened to be visited there by an enterprising lady pupil, Dr Bhatia, who was then returning from England to Delhi We discussed the problem of locating Sakāvand , which I conjectured should be somewhere in the region of Pul-i 'Ālam, a well known village of the Logar A few days later, by happy chance, she was conversing with an Afghan historian well acquainted with the district, who happened to mention that the village of Sakāvand was well known to local residents, and presumably occupied the mediaeval site We promptly applied to make a visit to the place, and are grateful to Dr Mustamindy of the Afghan Institute of Archaeology for approving our journey, and sending with us an official representative Mr Aram, a

young and active member of his Institute

The village of Sakāvand proved to be situated some 12 miles south-west of Barakī Bārak, the present administrative centre of the Logar I should perhaps mention that township is famous as one of the few places in the border region where the old Ormurī language is still spoken Residents of Peshāwar are likely to recall that there are several villages situated east of Peshāwar City which are named after the Ormurs, and are said to have been founded by people of this tribe, though I am told the Ormur language is not spoken around Peshāwar today There are, however, said to be speakers of Ormurī still residing at Kāniguram in Wazīristān The history and origin of the Ormurī tribe are likely to be of interest for residents of Peshāwar, and for this reason I mention their survival at Bārakī Bārak At Sakāvand, however, the villagers were Pushtu-speaking, and when asked about the historical remains, they guided us to a prominent spur situated just behind the village Along its crest ran a spine of rock to which could be seen clinging the remains of mud walls, and of a strong gatehouse built in the same material The shape of the doorway, with a slightly pointed arch, supports an attribution to the Ghaznavid period The remains are by no means well preserved, but they teach the valuable lesson that hope should not be abandoned of fixing the dates of the various indeterminate sand forts which are found everywhere in the Frontier region Often the shape and style of their arches and gateways can help to fix the date, so that a ruined and seemingly unimportant fort may prove to be an unrecognised monument from the heroic days of Islam In the case of Sakāvand, as I hope to show, there can be little doubt that the mud fort illustrated in my slide is that which was standing in the time of al-Bīrūnī, and which is mentioned in the *Qānūn* It is not unlikely that the astronomer spent the night here on one of his journeys to India, for one of the two possible routes would have passed this way He may also have made on the spot the observations on which his co-ordinates are based, and to which I shall return

A pre-Muslim temple was said to have existed at Sakāvand at the time of 'Amr b Layth On the ground it may be seen that the remains of the castle stand above, and partly overlie, a great square platform which occupies the end of the spur The nature of the underlying structure is not revealed by surface inspection, but towards the east end some stonework has been revealed by erosion We see here a rough type of diaper masonry, somewhat resembling indeed that of the Buddhist *stupas*, yet decidedly rougher and more irregular The square channel running across the top of my slide was formerly occupied by a great beam of timber revetment, of which fragments were still to be seen where it entered the stonework For the Institute of Archaeology at Kābul we were able to collect a specimen of this stonework, which proved to be derived from a great deodar tree, *Cedrus Deodara*, such as once grew in profusion in Khost, and northwards as far as the Peiwar Kotal, and on some of the spurs of the Spinghar Range, but are said to survive in relatively small numbers to-day The nature of the

building that once stood below the fort of Sakāvand is still obscure It may originally have been a Buddhist *stupa* of the Kushan period, perhaps adapted to Hindu use by the later Brahmin kings of Kābul, yet the domed outline typical of a *stupa* was not to be seen Again, it may have been a Kushan building other than a *stupa*, for example a fire-temple similar to the monument at Surkh Kotal which has now become famous Again we may consider that it was a building founded for Hindu worship under the Kābulshāhs, and founded perhaps no earlier than the 7th century A D These, of course, are questions that will only be answered by excavation, by an institute with adequate resources, and at some future date

At any rate, there is little doubt that these are the remains of the historic township of Sakāvand We can now return to the question of its co-ordinates On the modern map, the location appears to be Long 68° 47′ East by Lat 33° 57′ North We can see now that the figure for the longitude is wrongly pointed in the printed text of the *Qānūn* Instead of صرل we must read صدل which gives 94° 30′ East on al-Bīrūnī's notation After the subtraction of 26° the result will be 68° 30′ The error here, if error there be, is certainly not excessive, since his longitude falls only 15 miles from the true position of Sakāvand His latitude of 33° 40′ is similarly 17′ less than the location given on modern maps, again a discrepancy of a little over 15 miles However, before regarding as final our evaluation of this result, it seems desirable to check that the position on modern maps is strictly accurate and based on actual observation It should also be remembered that computations of latitude are dependent on almanacs, and those available to al-Bīrūnī, as he often points out, were not always reliable It would be interesting to learn the views of a qualified navigator who had gone over the workings of al-Bīrūnī as given in full, for example, in the *Tahdīd*, since it may be that the small discrepancy could be explained At any rate, the example of Sakāvand seems to show that when co-ordinates given are those of places accessible to our author, and the figures are given on his personal authority, the results are sufficiently accurate to be of help to the student of topography

It is possible to travel from Ghaznah to Peshāwar by way of Sakāvand, turning right into the Logar Valley from the Ghaznah-Kābul road, and continuing past the ancient and celebrated village of Charkh, and thence by several possible routes to the Jalālābād plain Having mentioned the village of Charkh, I cannot fail to notice its remarkable old mosque, which is the pride of the place The *mihrāb* and *qiblah* wall of the building are decorated with carved wooden panels bearing hexagon designs with Qur'ānic inscriptions in Kufic script This work is certainly as old as the Ghaznavid period, and it is not impossible that our author may himself have visited and prayed in this mosque With its running streams and orchards, the village of Charkh is likely to have a considerable population of cobras I was interested when the *mutawallī* of the mosque told me that the room behind the *mihrāb* where valuables were kept was frequented at night by a cobra which guarded it from intruders One naturally thinks of

the Nāga cult prominent throughout this district in pre-Islamic times, and known also at Sakāvand according to the tradition of the *Garshāspnāmah*

The more frequented road from Ghaznah to the plains runs directly through Kābul In the *Qānūn* (II, 574) the co-ordinates given for this famous city are صه کـ ، لج مه , this is converted into modern numerals as 95° 20′ East by 33° 45′ North Once more we subtract 26° from the longitude, leaving 69° 20′ East by 33° 45′ North On the modern map the longitude is only 10′ less, a very close approximation even if we have to assume that all the error here is on al-Bīrūnī's side The latitude, however, in the printed text of the *Qānūn* is more than a degree too low, and thus evidently wide of the mark However, this is not the end of the problem, as there are substantial reasons to believe that the figure of the *Qānūn* is here not that of al-Bīrūnī at all For in the *Tahdīd*, written as early as A H 416 (tr Jamīl 'Alī, Beirut 1967, p 86) our author gives a detailed account of the operations which he conducted at a village named Jayfūr, near Kābul, from which he calculated the latitude of that place as 34° 41′ East, a figure less than 5′ in excess of that shown by the present map The village of Jayfūr seems not to be known today, but whichever side of Kābul it may be supposed to have stood, the result comes very near to the correct figure There exists also a further calculation of al-Bīrūnī for the latitude of Kābul, quoted this time in the *Indica*, where the figure is 34° 47′ Though the figure for Jayfūr seems on present-day reckoning the most accurate, the last figure could be reconciled if we assume that the village lay 7 miles south of Kābul, the former figure being that for the village, and the latter for the city itself The first of the three figures, that of the *Qānūn*, is at first sight inexplicable There are two hypotheses which might help to account for it In the scientific works of the Muslim Middle Ages, the numerical entries are not always found to be correct The student would be expected to read the calculations and arguments, and work through the reasoning for himself He was expected to detect if the figures were corrupt, and substitute the results of his own working Not only were there sometimes copyists' errors in the manuscripts, sometimes also the authors may have included erroneous figures to check the attention of their students Similarly, where parallel works gave better results, the student might be expected to have knowledge of it

Another hypothesis may be considered to explain these discrepancies The tables of co-ordinates given by al-Bīrūnī may have been based on an earlier table, for the tradition of such gazetteers goes back to the *Geographica* of Ptolemy, each successive author may have made his own corrections and additions, while retaining some of the figures given by his predecessor In just the same way, Akbar's minister Abū al-Faḍl reworked the lists of al-Bīrūnī, yet the origins of the later gazetteers are evident from the presence in it of such names as, for example, Ribāṭ al-Amīr, which we shall shortly discuss We shall see that this settlement was founded only under Sabuktegin, and must have disappeared after the Ghaznavid period It can hardly have been frequented

during the time of Akbar, and its full co-ordinates seem to have been unknown to Abū al-Faḍl In just the same way, al-Bīrūnī may have been employed in up-dating and correcting an earlier list Where the results of his own observations had been given in previous works, he may simply have allowed the traditional figures to stand, but expected, perhaps, that the student would be of the correction

It is likely that when our author was brought from Khwārizm to Ghaznah in the train of Maḥmud in A H 408, he travelled by way of Bāmiyān and Parwān We may turn aside from the direct route for a moment to examine his data on these localities Parwān is known as a mint of Ghaznavid coins, and the scene of a battle of Jalāl al-dīn Menguibirtī against the Mongols It is supposed, without definite evidence, to lie in the neighbourhood of Chārikār The co-ordinates in the *Qānūn* are صلى لا له I no longer show my working, but give the converted equivalent as 68° 10′ East by 34° 35′ North Chārikār is almost due north of Kābul, but this longitude indicates a site almost a degree further to the west Moreover, the spot indicated by the latitude is actually further south than al-Bīrūnī's approved figure for Jayfūr Unless Raverty was right in placing Parwān somewhere in the vicinity of the Hajigak Pass in Central Afghānistān, a theory in support of which there is no other evidence, we are obliged to admit that the co-ordinates for Parwān are not reckoned with that order of precision which we have come to expect in the personal observations of the *Ustād* Rather similar is the case of the figures for Bāmiyān, a place in which he certainly took an interest The two great Buddha images which are still the wonder of this site were designated by the names of Khing But and Surkh But ('The Grey Buddha' and 'The Red Buddha') as early as the ***Hudūd al-'Ālam*** 'Unṣurī, the court poet of Maḥmūd of Ghaznah actually wrote a romance about these idols, though its contents are likely to have had more folkloristic than archaeological value Of this poem al-Bīrūnī had written an Arabic translation, as he had of the same author's poem *Wāmiq wa 'Adhrā*, and his knowledge of the two figures appears in the *Qānūn* when he names them in Arabic as *al-ṣanam al-ahmar wal-akhab, kul wāhid saba'ūna dhirā'an* 'The Red idol and the Grey Idol, each of them being seventy cubits' The smaller of the two figures is indeed 35 metres high, which would be equivalent to seventy cubits, and the larger over 50 metres, or 100 cubits We may wonder whether the sage applied his mathematical skill to calculating the height of the smaller Buddha The co-ordinates for this well known spot are given as ر مس ن لد ه، which I convert according to my usual procedure as 66° 50 East by 34° 15′ North This location is nearly a degree too far west, but only about 20 miles south of the currently accepted position of Bāmiyān While the latitude may be a personal observation, the discrepancy of longitude may result from its being based on dead reckoning during al-Bīrūnī's journey from Khwārizm, or it may have been a traditional figure taken from earlier books

We may take next al-Bīrūnī's figures for the district of Nejrāb, the present-

day Nejrão The *abjad* notation gives صديه لدم which after conversion results in 68° 15′ East by 34° 40′ North Granted that the district headquarters of Ghaznavid times was located near its present situation, the latitude is once more almost exact On the other hand the longitude is almost a degree too low Passing next to Lāmghān, we find that the longitude given in the *Qānūn* صوى equivalent to 70° 10′ East, is almost exact However, this time it is the latitude لج ن equivalent to 33° 50′ North, which is implausible, being nearly 50′ too low Once again, this is a case where there are doubts whether the incorrect figure in the *Qānūn* is indeed the author's own In the *Indica* a totally different latitude is quoted for Lāmghān, 34° 43′ North, and this is actually in agreement with the modern map It is known from the *Tahdīd* (tr Jamīl 'Alī, p 261) that al-Bīrūnī personally visited Lāmghān on at least one occasion, in Dhū al-Qa'da A H 409, and observed there, at dawn, a solar eclipse That he personally ascertained the latitude is all but certain, and the conflict of evidence between the *Indica* and the *Qānūn* thus especially puzzling We must evidently assume that the latitude given in the *Indica* represents the author's intention, and his co-ordinates for Lāmghān thus remarkably accurate

It is valuable to have this assurance of our author's accuracy, before passing to his next station, probably that of the greatest archaeological interest This is the settlement curtly noted in the *Qānūn* as *Ribāṭ Kindī, al-ma'rūf bi-Ribāṭ al-Amīr* 'The guard-house of Kindī, known as the guard-house of the Amīr' The importance of this place is explained in a detailed historical source It is the *Ādāb al-harb wal-shaja'a*, a treatise on the art of war, written in the time of the Delhi Sulṭān Iltutmish (607/1210 to 633/1235) by a certain Muḥammad b Manṣūr, known as Mubārakshāh and Fakhr-i-Mudabbir We are told in connexion with the celebrated defeat of the Kābulshāh Jaypāl by Maḥmūd near Peshāwar in 391/1000, the story of how the conqueror's father Sabuktegīn had previously defeated the same king in the plain of Kindī near Jalālābād, and built as a memorial of the battle the ribāṭ known as Amīr Kindī The place became a famous resort of Muslim campaigners, and contributed to the fame of Sabuktegīn The later Sulṭān Shihāb al-dawlah Mawdūd defeated the murderers of his father in the same district, and built a second *ribāṭ* which was known as Fatḥābād From the archaeologist's viewpoint, if these two *ribāṭs* were built as memorials, they are likely to have been strongly constructed and splendidly decorated In spite of the dire vicissitudes which were later to befall the Muslim monuments of Afghanistan, there is every chance that remains of historical interest could still exist at these sites There is thus special interest in seeking to determine their positions

At this point the text of Fakhr-i-Mudabbir, which I have been closely paraphrasing here, voices an eloquent thought which I may perhaps be allowed to quote in the original Persian

Izid - ta'ālā - ān pādishāhān rā bi-āmurzād kih dar 'ālam nīknāmī

> bi-guzashtand, ū tā khishtī az ān bar jai ast, nām-i Ishān zinda ast Tā har kih pādishāh bāshād chīzī pas as khud bi-guzārad, tā nām-i vay zinda bi-mānad
>
> 'May God Most High grant forgiveness to those rulers who have left a fair reputation in the world, and as long as a single one of those bricks stands upon its foundations, their name is perpetuated To the end that everyone that shall become a ruler shall leave some memorial of himself behind, so that his name shall be kept alive'

Taking these words as my cue, I shall seek your permission to digress for a few minutes from my main theme, in order to mention two of the distinguished Muslim rulers whose patronage had supported al-Bīrūnī before his arrival in Ghaznah, and to remind you also of the two very interesting buildings that are associated with these princes One of these buildings is very well known today, and in fact may be reckoned the most famous Muslim monument of present-day Iran The second, however, is today all but forgotten Yet each of them bore an Arabic inscription which tells something of its story, and which shows how closely each was associated with the lifetime of the sage There can be little doubt that our author personally visited both of these monuments The definite evidence goes no further than this, yet we might be tempted to guess that owing to the unusual character and quality of the first of these buildings, and some special points which arise from both of the inscriptions, both could have had a closer connexion with the astronomer For both the buildings were prominent towers, which even if not specially designed for an astronomical purpose, could have played a useful part in astronomical calculations Moreover, since al-Bīrunī was effectively the scientific adviser to each of the rulers at the time the buildings were erected, it could reasonably be inferred that he played some part, at least, in their planning and supervision, and that something of the unique quality of the former building may be due to his genius This question, however, is one that I must leave to my hearers to decide My task here is merely to present the evidence

The first building to which I refer is of course the famous Gunbad-i-Qābūs (I use, for the moment, the Arabic spelling of the latter name), which stands at the township similarly named in Gurgan Province, Iran As the illustration shows, the building is not actually a dome, as the name suggests, but a high, pointed tower A tradition exists that it represents the tomb of the stern yet philosophically-inclined prince whose name it bears Yet investigations of the structure in recent times have revealed no trace of a burial chamber, and the Arabic inscription which it bears, whether on account of the builder's stoical imperturbablity or simply by a statement of sheer fact, makes no explicit mention that its purpose was for a tomb The short and elegantly carved Arabic

inscription which it bears, drafted in rhyming prose, is exceedingly well known

Hādhā al-qaṣru al'ālī, li al-amīri Shamsi al-Ma'ālī
al-amīru 'banu al-amīr Qābūs ubnu Wushmgīr
amara bi-binā'ihi fī ḥayātihi
sannata saba wa tisa'īna wa-thalāthami'ah qamariyah
wa-sannata khamsa wa-saba 'īna wa-thalathami ah shamsiyyah

'This elevated palace belongs to the *amīr* Shamsu al-Ma'ālī The *amīr* who is son of the *amīr*, Qābūs son of Wushmgīr gave orders for the building of it during his lifetime, in the lunar year 397, and the solar year 375'

There is only need here to mention three points The appearance of the building is striking, and modern observers have been quick to remark on its strange, though quite accidental resemblance to a space vehicle The fact that, as the late Professor Vladimir Minorsky has said this is 'the oldest architectural monument standing intact in Persia', is testimony to its unusually sound and robust design Finally, the wording of the inscription is almost unique amongst the Islamic inscriptions of Iran in giving the date not only according to the Hijrah Era, but also according to the solar Zoroastrian Era of Yezdagird The use of the latter is reminiscent of the practice of al-Bīrūnī at many points in his astronomical work, where he often gives a double dating both to fix the moment in time with the greatest precision, and to enable an astronomer to refer it to an almanac drawn up on the basis of a solar calendar Furthermore, it should not be overlooked that the date given 397/1006, fell in fact during the period when al-Bīrūnī resided at Jurjān, the capital city of Qābūs, of which the famous monument still helps to indicate the site

By comparison with the tower of Qābūs, the second monument of which I have to speak is little known It is a tower of which the remains are nearly, perhaps even totally destroyed today, and of which the former existence is revealed by a leaden plaque which is still to be seen in the Historical Museum at Tāshkent I owe my opportunity of studying it to a tour in Uzbekistān hospitably arranged by the Institute of Oriental Studies of the Academy of Sciences of the U S S R during June and July 1972, within the framework of their academic exchange programme with my own institution, the School of Oriental and African Studies, University of London I am grateful to the authorities of the Museum for allowing a photograph to be taken, and to my guide and interpreter, Mr Igor Klotchkoff, for making the arrangements on my behalf, and also allowing me to use a photograph taken by himself at the same time

The Arabic inscription cast upon the plaque was first published in a pre-revolutionary Russian Orientalist journal, in a transcription that was very

nearly correct (N Katanov, 'Khorezmiiskaya svinstovaya plita, naîdennaya v razvalinakh Kunya-Urgencha', *Zapiski vostochnago otdyeleniya imperatorskago russkago arkheologicheskago obshchestva* XIV, 1900, 015-017) In the version which I give here, I have taken the opportunity to correct one or two minor misprints in the published reading

> Amara al-amīr al-sayyid al-malik al-'ādil Abū al-'Abbās Ma'mūn bin Ma'mūn Khwārizmshah bi-binā'i hādhihi al-manāra, wa hadarahā bi-nafsihi,
>
> wa-tawallā wad'a āsāsihā, tawādu 'an li al-dīn wa-taqarraban ilā Allāh ta'āla
>
> dhikrahu, wa-raghbatan fī thawābi al-dārayn, wa dhālika fi shuhūrin sannati iḥdā wa-arba'mi'ah

'The *amīr*, the lord, the just prince Abū al-'Abbās Ma'mūn b Ma'mūn Khwārizmshah gave orders for the building of this tower, and he visited it in person, and supervised the laying of its foundations, in humility towards the faith, and seeking the favour of God, whose Mention is Exalted, and desiring his reward in both worlds It happened in the year 401 '

Although, as at Gunbad-i Qābūs, the text does not explicitly connect the monument with al-Bīrūnī, there are several details which tend to suggest his participation During the year in question, the astronomer was in fact living under the patronage of al-Ma'mūn, whose kindly treatment of him he mentions in several passages of the *Tahdīd* No doubt he often advised the prince on scientific matters The claim made by al-Ma'mūn to have personally visited the site of the tower, and even to have directed the laying of the foundations, is definitely unusual for an Islamic ruler It not only suggests the scientific and technological interests for which al-Ma'mūn is well known, but also, of course, the intervention of the scientific advisers of the prince The casting in lead of an Arabic inscription is in itself a remarkable procedure, a definite technical innovation, and I know of no other example of this kind The close interest taken by the ruler suggests that the tower may have been planned to serve some technical purpose Although the only specific observations mentioned in the *Tahdīd* relate to the year 407, and so did not directly follow the building of the tower, it is evident that a tower of known height and position could have served many functions in Abū Raiḥān's astronomical and geographical calculations

Returning once more to Ribāṭ Kindī, the association of that still undiscovered monument with the greatest of Muslim scientists is of course less immediate It had been built in the reign of Sabuktegīn, at least 22 years before his visit to the area, and although the monument to his father's memory may have

been embellished by Maḥmūd during one of his expeditions down the Kābul River valley with al-Bīrūnī in his train, the astronomer was not likely to have exercised sufficient influence at that time to have played a leading role in the planning of any such works None the less, its mention in the *Qānūn* suggests that Abū Raiḥān was familiar with the place, and he may well have lodged there during one of his journeys through the district, especially since there is unquestionable evidence in the *Tahdīd* that he was active a few miles away in Lāmghān I was, therefore, eager to ascertain whether the remains could be located from his co-ordinates, which are printed as صمه ن لج م As in earlier cases, I convert these into current figures as Long 69° 40′ East by Lat 33° 40′ North In the *Indica*, however, the latitude is given as 33° 55′

During my stay in Kābul in 1969, during the days which followed my visit to Sakāvand, I spent several days, in the company of the Institute representative Mr Aram, in scouring the western fringes of the Logar Valley in the general vicinity of this plot, but entirely without result Some days later, when I happened to discuss the problem with the well known scholar at Kābul, Professor 'Abdul Haī Habībī, he called my attention to the very interesting fact that the present-day map records a village named Kindibagh, not indeed within the confines of the Logar, but well below the Lattaband escarpment on the fringe of the Jalālābād Plain, and about ten miles south of Jalālābād itself I have had no opportunity to visit Kindibagh, and have no means of ascertaining whether the spot is marked by the remains of a Ghaznavid *ribāṭ* At first sight the place seems a suitable location for the famous battle in which Sabuktegīn fell upon the army of the Kābulshāh Jaypāl, as narrated by al-'Utbī Yet, if this identification should prove correct both the latitude and the longitude given in the *Qānūn* are nearly a degree too low What can be the explanation for such a discrepancy? It could be argued that al-Bīrūnī made no observations for this locality, and that the figures are based on no more than dead reckoning for the overland journey, a circuitous route in mountainous country, or even from rough and ready itineraries used by the Ghazanvid administration Yet no final verdict on this question is possible until the remains of Ribāṭ Kindī have been definitely found

The next site noticed in the *Qānūn* is Dunpūr or Dinpūr The co-ordinates given are صوكه لج مه , converted as Long 70° 25′ East by Lat 33° 45′ North The last figure, like that given for Kindī in the *Qānūn*, is obviously too far to the south But in any case, there is once more evidence that it was not al-Bīrūnī's authentic figure for the latitude of Dunpūr, specifically quoted in the *Indica* as 34° 20′ North, which is obviously more plausible With this evident correction, the co-ordinates seem nearly correct for Kindibagh The possibility must be considered that the names in the list have been disarranged, that the figures quoted are those for Ribāṭ Kindī, and that those for Dunpūr have been omitted However, there is other evidence for the position of Dunpūr In the *Hudūd al-'Ālam* (p 92) it is said to stand 'opposite' to Lāmghān on the

bank of a river It is thus identified with the town of Adīnpūr mentioned in the *Bāburnāmah*, which was then the governor's residence of Ningrahār, 13 *farsakhs* east of Kābul by a poor road, and on the northern bank of the Surkhrūd River It is vividly described by the Emperor Bābur as standing on an isolated hill, its southern cliff falling directly into the river, and detached from, but backed by the spur of the Siyāh Kūn range Such a site for Adīnpūr should be immediately obvious to any traveller passing upstream along the Surkhāb River from the direction of Jalālābād Yet if this identification for Dunpūr should be proved correct, it gives rise to another awkward difficulty

According to the figures given in the *Qānūn*, Kindī lies 45′ west of Dunpūr Al-Bīrūnī's own conversion tables given in the *Tahdīd* (tr Jamīl 'Alī p 182) reckon the linear equivalent at a little above 42 miles Yet if it is ultimately confirmed that Kindī is identical with Kindibagh, and Dunpūr with Adīnpūr, the first of these places is 20 miles *east* of the second It is difficult to charge the Master Astronomer with so obvious a discrepancy We have already considered the possibility that names and figures in the manuscript have been transposed at this point This explanation would certainly provide one way out of the difficulty On the other hand, plausible as these identifications are, they have not yet been checked by observations on the ground It is possible that one or other might prove illusory, and that Ribāṭ Kindī is indeed near the spot which the co-ordinates suggest, in Khugiānī country along the upper waters of the Surkhāb stream, near the passes which lead west into the Logar Valley

Thus we reach the final stage in this part of Abu Raihan's itinerary, the city of Peshāwar itself Here we find simultaneous proof of our author's accuracy, and at the same time the problem of a discrepancy The figures given in the *Qānūn* are صرى، لج له Conversion on the basis adopted for this paper gives the result Long 71° 25′ East by Lat 35° 35′ North Since the modern co-ordinates are Long 71° 31′ East by Lat 34° 01′ North we see that the first figure is almost exact, and being within 4, or a little over 3 miles from the true location, would (in the case of an unknown site) be amply sufficient to guide an archaeologist The second figure, that of latitude, remains puzzling As quoted in the *Qānūn* it is 33° 35′ North, which is nearly 25′ south of the present position of Peshāwar, a rather large margin of error At the same time, it disagrees with the latitude for Peshāwar given in the *Indica*, where it is 34° 44′ North, actually 43′ too far North It is not possible to rule out all possibility of errors by al-Bīrūnī in the tables of the *Qānūn* As he says in the *Tahdīd*

> The following examples will serve as guides to the calculator and as aids for formulation and investigation I do not feel secure against the occurrence of slips in the calculations, because of the intensity of my worries God is the best guide to the truth !

In the case of Peshāwar, there is, however, one other very interesting possi-

bility. We may consider whether discrepant figures in the *Indica* and in the *Qānūn* could not have resulted from observations made at different times As we know from the anecdote of observations made at Jaypūr, al-Bīrūnī often had to use makeshift instruments which did not give results of minute precision. If therefore we take the average of the two figures given for Peshāwar, Lat 33° 35′ North and 34° 44′ North respectively, the result is 34° 09′ North, which is 8 minutes north of the actual site, or a little over 7 miles This is a far more satisfactory conclusion, and it is possible that this explanation is a valid one The present speaker has had no opportunity, during the preparation of this paper, to check the latitudes of all 11 places of which the author gives latitudes in the *Indica* against those quoted in the *Qānūn* to see whether the same explanation holds also for them An astronomer too would be needed to verify the method by which al-Bīrūnī calculated his latitudes, and ascertain whether some of the errors could not have arisen from the use of inadequate almanacs current in his time, and the faults of which he constantly had to criticise A hearer more fully versed in astronomical theory may be able to deduce the precise source of some of the minor discrepancies occurring in the tables of the *Qānūn*, and could therefore hope to arrive at the correct location of unknown sites As you will observe, I am here making no attempt to check the locations of places visited by al-Bīrūnī in Pakistan No doubt this is a task being undertaken by local scholars

Before I sum up, it seems of interest to mention two other obscure places, each of historical interest, located by al-Bīrūnī One of these is the locality called Karūr, which he places in Long 69° 15′ East, Lat 32° North The place is mentioned again in the *Ādāb al-harb wal-Shaja'a*, where it is named as the source of a particular type of bow used in hunting, and also in the tale of a wounded soldier who travelled there from Multān The co-ordinates fix the position in the valley of the River Gomal about 30 miles S W of Wana, and not far from the Durand Line I shall have to depend on members of the audience to tell me whether such an archaeological site exists in that area

The second place of interest mentioned by the *Qānūn* in the same general area is Farmul, placed by al-Bīrūnī in لس يه لد له Conversion to the modern base yields Long 68° 35′ East by 32° 15′ North, a plot on the upper valley of the Gomal River about 30 miles south of present-day Urgun The tribal name Farmuli is fairly prominent during political events of the Sultanate of Shēr Shāh, and was in fact identified by Elphinstone (*An Account of the Kingdom of Kābul* II, 158) as that of a Tajik group at Urgun itself It would be interesting to know whether the name is one that still occurs today

In my paper I have tried to explore, with mixed success, some of the co-ordinates given by Abū Raiḥān for localities in Afghanistan and along its borders We can be sure that the greatest of Muslim scientists knew these lands, so close to his home at Ghaznah, better than geographers usually do today That there

are some errors in the figures given in his lists has always been assumed, but I have tried to show that when he fixes the positions on his personal authority, many of the results show a high degree of precision Such results can be valuable to the archaeologist who seeks the unidentified ancient sites of the Afghan border, though several puzzling difficulties still remain Sometimes our author contradicts himself in different passages, and sometimes we can locate his stations on the ground Perhaps the most interesting of all the sites is Ribāṭ Kindī, scene of the victory of Sabuktegīn over Jaypāl, which has still to be found Of interest too are the parallels between al-Bīrūnī's tables, and the anecdotes in the *Ādāb al-harb* Both may occasionally reflect al-Bīrūnī's lost *Kitāb ta'rīkh ayyām al-Sulṭān Mahmūd* This discussion has touched upon some of the problems which the compiler of a definitive commentary on the *Qānūn* would need to cover, though we must admit that the encyclopaedic knowledge of our author, and the complex nature of his sources and calculations, would make any such undertaking a most exacting assignment

THE KITĀB NUZHAT AL-NUFŪS WAL-AFKĀR

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IN his well-known bibliography "*L'oeuvre d'al-Bīrūnī, Essai bibliographique*", Boilot mentions under the number 157 the *Kitāb nuzhat al-nufūs wal-afkār fī khawās al-mawālīd al-thalāth al-ma'ādin wal-nabāt wal-aḥjār* or "The Recreation of the Souls and the Thoughts on the sympathetic qualities of the three Realms of Nature, the Minerals, Plants and Stones" The only known manuscript of this text is in the Bodleian Library in Oxford (Nr I, 519)

Boilot's statement seems, however, not to be based on an autopsy of the manuscript or, at least, not on a thorough investigation of it For, had he taken the pains of reading only a few pages of this work, deep doubts as to the authenticity of the book would have arisen in his mind And these doubts would finally have been confirmed by unmistakable evidence The book *Nuzhat al-nufūs* is either a late falsification or has (at least) been erroneously ascribed to al-Bīrūnī The latter has apparently been done by the copyist of the book, the full title for which is given as follows

K nuzhat al-nufūs etc *li Abū Raihān al khwārizmī*

You will have observed that in the name of the author the crucial part, the *nisbah al-Bīrūnī*, is lacking, which means that there is a third possibility the author could be a partial namesake of al-Bīrūnī The hand that has written this title is apparently the same as that of the whole text But the copyist has concealed his name There is no colophon, and there is neither date nor signature The book ends with the simple statement *intihā al kitāb al-musammah bi Nuzhat al-nufūs wal-afkār* etc *wal-ḥamdu li Allah Waḥdih, tammah* The book is not mentioned by Ullmann in either of his two masterly books on the medicine and on the occult sciences in Islam and he wrote me that he doesn't know the manuscript Does the title itself arouse any doubt as to the authenticity? I don't really think so Certainly, the pompous wording is uncommon to Bīrūnī

And titles beginning with *nuzha* usually point to a later period as e g the ***Kitāb nuzhat al-albāb fī mā lā yujādū fī Kitāb*** by the Egyptian lapidarist Aḥmad b Yūsuf al-Tīfāshī (died 651/1253), the famous *Kitāb Nuzhat al qulūb* by Mustaufī Qazwīnī (died 740/1340), or the *Kitāb al-Nuzhah al-mubhijah fī tashḥīdh al-adhhān wa ta'dīl al-amzijah* by the well-known pharmacologist Dāwūd al-Anṭākī (died 1008/1599)

Nevertheless, there are rhymed titles to be found in the work list of al-Bīrūnī as e g the *K al-tafhīm fī awā'il sinā'ah al-tanjīm* But even, if the form of the title might give rise to a certain suspicion, nothing of the like is, I think, true for the meaning of it

To deal with the *khawāṣ* or sympathetic qualities of created things is, of course, magic, if judged by the strict laws of modern critical science But it was regarded as a serious and rational science in the time of al-Bīrūnī Nothing would, therefore, tell against the possibility of al-Bīrūnī having written a work on the *khawāṣ*

Let us dwell a few minutes on this point We know that the so-called occult sciences, alchemy, astrology and magic, were part of the Hellenistic legacy inherited by Muslim scholarship Even Plato and Aristotle were not spared the magic halo The Book of Stones attributed to "The First Teacher" - but according to modern scholarly insight an Arabic compilation - is full of magic, Bīrūnī being the only Muslim scholar to have uttered some doubt in its authenticity

But even Bīrūnī's famous Book of Stones, though credited with being the most important Arabic lapidary, contains some magic stories and quotes - among similar sources - the well-known *Kitāb al-khawāṣ* of Abū Zakarīyā al-Rāzī If al-Rāzī, the torch-bearer of rationalism in medieval Islam, refrained neither from writing a book on the sympathetic qualities nor, by the way, from deeply delving into alchemical cookeries, then, why should al-Bīrūnī not have done the same? And we know that he did not altogether refrain from such things

His *Kitāb al-tafhīm* is, by no means, a disguised refutation of the *'ilmy ahkām al-nujūm*, as one of our Iranian colleagues tried to show in Teheran, but on the contrary a book that treats astrology as a serious secular science based on a natural regular interdependence between the movements and qualities of the stars and human character and behaviour, things which can be found out by positive knowledge and a certain number of sciences into which Bīrūnī introduces the reader of the *Tafhīm*, such as arithmetic, trigonometry, geodesy, chronology, astronomy and others

There is thus no serious obstacle for the assumption that Bīrūnī could have written the book on the *khawāṣ* But what discards the possibility of his being the author of the *K Nuzhat al-nufūs wal-afkār* is the book itself

Let me now give you a short outline of its contents. The book being incomplete at the beginning and therefore lacking an introduction, the text flows after some lines into a discourse on the so-called coloured magic stones, which, as Ullmann points out in his afore-mentioned book on the occult sciences, may be traced back to a Pahlavi source and form part of most of the Arabic lapidaries

A series of further stones follows, all of them more or less known from earlier lapidaries, as for example the *hajar al-khuttaf* or swallow-stone, the *ḥajar al-bāh* or stone of sexual potency, the *ḥajar al-'uqāb* or eagle stone, the diamond and a set of magnetic stones attracting respectively gold, silver, iron, lead, bones, hair and wool

The next maqālah is that on the minerals, plants and animals It starts with a short contemplation about the origin of these realms and their respective phenomena, deriving them from dust, vapors and waters together with the influence of the sun upon them, and connecting them with each other in what the author calls "a marvellous graduation" or "hierarchy" reaching from the dust to the angels, which reminds us of Darwinism but has, of course, nothing to do with it

The text now turns to the discussion of the minerals, dividing them into forgeable and non-forgeable ones, the latter ones being non-forgeable because of their solidity or hardness, as is the case with rubies, or because of their excessive softness, as is the case with salt

After the minerals, the author treats plants and animals, then discusses the parturition, the sympathetic qualities and advantages (*manāfi'*) of man, and finally mentions a number of strangely shaped creatures (*makhlūqāt 'ajībat al-askhāl*), as Siamese twins, and a number of strange "*umam*" or people as an *ummah* with the faces of dogs, another *ummah* whose people have two heads and eight feet, one head and four feet at the bottom and a second set of these limbs in the air, using the upper set when the lower has been fatigued by a long race, and another *ummah* with no heads at all, and with mouths on their breasts

The last part of the book consists of stories of strange cities, as the Egyptian Gizā with its pyramids, and of strange and miraculous events, some of which are known also from the 1001 nights, as that of the merchant who was saved from an isolated island by clinging to the claws of a huge bird, or the long story of Bulūqiyah, the Jewish magician who travelled around the world

All this is, of course, no definite proof of the spuriousness of our text Let me therefore shed some light on the scientific level of the book in order to convince you before giving you the final argument which will clear away the last dot of doubt

The scientific level is indeed much inferior to what we are accustomed to in al-Bīrūnī's books The main interest of our author is in "mirabilia", in magic effects and miraculous events With a completely uncritical mind he seems to accept everything, as long as it appeals to his magic-ridden fancy

Thus, he mentions the following details about the guardians of the three pyramids in Gīzā The guardian (*khāzin*) of the western pyramid is a granite statue (*sanam*) of a standing man with a lance in his hand and a snake around his head And if anybody approaches him, the snake will attack him, wind around his neck until he falls dead and then return to its place Accordingly, the guardian of the eastern pyramid is described as killing by his voice whoever looks at him, while the third guardian accomplishes the same by attracting the approaching victim with magic force until he sticks to the statue

There are plenty of such incredible stories, which Bīrūnī certainly would not have thought worth relating, or would at least not have written down without a critical remark or without rejecting the whole story as superstitious Sources are seldom referred to And if so, the reference as a rule is vague, with only the author being named Once or twice Aristotle and Hippocrates are mentioned, the latter in connection with the development of the embryo, that is to say that in all probability, these quotations stem from the *Kitāb al-Janīn* or "Book of the Embryo" by Hippocrates, but the author is, as always, silent upon the title

I need not emphasize how much this attitude is different from al-Bīrūnī's, as we meet it for example in his *Kitāb al-Hind*, where rich and exact reference to the sources is usually given

On the scientific garb of the book Nuzhat al-nufūs also the quotations from the *ḥadīth* in scientific matters is typical But I will not dwell on this point here

Let me now reveal the decisive arguments for the spuriousness of our text It lies in the fact that in the last part of the book, where mention is made of strange races and peculiar creatures, we meet several times the name of al-Qazwīnī, which cannot refer to anybody but the famous Zakarīyā b Muḥammad b Maḥmūd al-Qazwīnī, the author of the *'Ajā'ib al-makhlūqāt*, or "The Wonders of Created Beings" who died 682/1283 Yes, there is even a quotation of Abū al-Raiḥān al-Khwārizmī, that is to say Bīrūnī himself It runs as follows Sanjar b Nūḥ b al-Manṣūr the Samanid was presented a horse with two horns on his head, and two foxes, each of them with two wings of feathers which they would spread when somebody approached them, and put under their shoulders after he went away People sometimes wonder about a flying fox, but foxes do fly in the time of? (an unreadable expression follows) This is what our author has found worth quoting in al-Bīrūnī

Let me close with the following remarks We know almost nothing of the author of the *K Nuzhat al-nufūs*, not even his name, except that he apparently was a namesake of al-Bīrūnī - in the sense that he was called Abū al-Raiḥān al-Khwārizmī We may only guess that he lived in the time of, or some time after, al-Qazwīnī, that is to say, at the earliest in the 13th century A D And we now know that he and not al-Bīrūnī was the author of the *Kitāb Nuzhat al-nufūs,* a book so different in spirit from all we associate with al-Bīrūnī, and yet so typical of most of what manifests itself in the later centuries of the Islamic culture, when science and religion and magic were mingled into one indissoluble amalgam

AL-BĪRŪNĪ'S INDICA - A RE-EVALUATION

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AL-Bīrūnī's *Indica* is the first great book on the cultural history of the Hindus from the pen of a Muslim scholar No Muslim has ever reached the depth and the extent of the scholarship that al-Bīrūnī could master In subsequent centuries several Muslim authors have written on philosophy, religion or society of the Hindus, and some have translated Hindu works into Arabic or Persian But none of them possessed as deep an insight into the Hindu ways of living, thinking and acting as al-Bīrūnī could acquire within the brief span of life that he spent in the country His scholarship was suffused with sympathy and his attitude was understandability rather than disparaging the unfamiliar habits and customs The breadth of his vision and the appreciation of the knowledge possessed by others enabled him to get at the root of the information and communicate that to his fellowmen in the spirit of a true scholar Such information was neither twisted nor adversely commented upon Al-Bīrūnī's purpose was not to justify or condemn He was aiming at introducing the Hindu society and the Hindu science to the Muslim world Communication was his chief end In this task he was greatly helped by his learning of Sanskrit and by his personal contacts with many Hindu Pandits He was fully aware of the hatred of the Hindus towards the Muslims and at the same time he was conscious of the fact that the Muslim invaders had caused ruin in the Hindu homes While he deprecated the destruction, he criticised the haughtiness of the Hindus and their spirit of non-communication He says

"Their scattered remains cherish, of course, the most inveterate aversion towards all Muslims This is the reason, too, why Hindu sciences have retired far away from those parts of the country conquered by us, and have fled to places which our hand cannot yet reach, to Kashmir, Benares and other places And there the antagonism between them and all foreigners receives more and more nourishment both from political and religious sources" Again he writes "They totally differ from us in religion, as we believe in nothing in which they believe, and *vice-versa* On the whole, there is every little disputing about theological topics among themselves, at the utmost, they fight with words, but they will

never stake their soul or body or their property on religious controversy. On the contrary, all their fanaticism is directed against those who do not belong to them—against all foreigners They call them *mlechcha*, i e impure, and forbid having any connection with them, be it by inter-marriage or any other kind of relationship, or by sitting, eating, and drinking with them, because thereby, they think, they would be polluted They consider as impure anything which touches the fire and the water of a foreigner, and no household can exist without these two elements Besides, they never desire that a thing which once has been polluted should be purified and thus recovered, as, under ordinary circumstances, if anybody or anything has become unclean, he or it would strive to regain the state of purity They are not allowed to receive anybody who does not belong to them, even if he wished it, or was inclined to their religion This, too, renders any connection with them impossible, and constitutes the widest gulf between us and them"

Al-Bīrūnī marks out one national feature of the Hindu national character "We can only say, folly is an illness for which there is no medicine, and the Hindus believe that there is no country but theirs, no nation like theirs, no kings like theirs, no religion like theirs, no science like theirs They are haughty, foolishly vain, self-conceited and stolid They are by nature niggardly in communicating that which they know, and they take the greatest possible care to withhold it from men of another caste among their own people, still much more, of course, from any foreigner According to their belief, there is no other country on earth but theirs, no other race of man but theirs, and no created beings besides them have any knowledge or science whatsoever Their haughtiness is such that, if you tell them of any science or scholar in Khurāsān and Persia, they will think you to be both ignoramus and a liar If they travelled and mixed with other nations, they would tne their mind, for their ancestors were not as narrow-minded as the present generation is One of their scholars, Varahamihira, in a passage where he calls on the people to honour the Brahmans, says "The Greeks, though impure, must be honoured since they were trained in sciences, and therein excelled others What, then, are we to say of a Brahman, if he combines with his purity the height of science?" In former times the Hindus used to acknowledge that the progress of science due to the Greeks is much more important than that which is due to themselves But from this passage of Varahamihira alone you see what a self-lauding man he is, whilst he gives himself airs as doing justice to others At first I stood to their astronomers in the relation of a pupil to his master, being a stranger among them and not acquainted with their peculiar national and traditional methods of science On having made some progress, I began to show them the elements on which this science rests, to point out to them some rules of logical deduction and the scientific method of all mathematics, and then they flocked together round me from all parts, wondering and most eager to learn from me, asking me at the same time from what Hindu master I had learnt those things, whilst in reality I showed them what they were worth, and thought myself a great deal superior to them, disdaining to be put on a level

with them They almost thought me to be a sorcerer, and when speaking of me to their leading men in their native tongue, they spoke of me as the sea or as the water which is so acid that vinegar in comparison is sweet"

And yet al-Bīrūnī left no stone unturned to teach himself all that was possible about the Hindus His thirst for knowledge was insatiable, and any effort, however arduous it may be, to get the knowledge was not impossible for him He says "I have found it very hard to work my way into the subject, although I have a great liking for it, in which respect I stand quite alone in my time, and although I do not spare either trouble or money in collecting Sanskrit books from places where I supposed they were likely to be found, and in procuring for myself, even from very remote places, Hindu scholars who understand them and are able to teach me What scholar, however, has the same favourable opportunities of studying this subject as I have? That would be only the case with one to whom the grace of God accords, what it did not accord to me, a perfectly free disposal of his doings and goings, for it has never fallen to my lot in my own doings and goings to be perfectly independent, nor to be invested with sufficient power to dispose and to order as I thought best However, I thank God for that which He has bestowed on me, and which must be considered as sufficient for the purpose"

As far as al-Bīrūnī's method of communication is concerned, he himself enlightens us "In most parts of my work I simply relate without criticising, unless there be a special reason for doing so I mention the necessary Sanskrit names and technical terms once where the context of our explanation demands it If the word is an original one, the meaning of which can be rendered in Arabic, I only use the corresponding Arabic word, if, however, the Sanskrit word be more practical, we keep this, trying to transliterate it as accurately as possible If the word is a secondary or derived one, but in general use, we also keep it, though there be a corresponding term in Arabic, but before using it we explain its signification In this way we have tried to facilitate the understanding of the terminology"

Al-Bīrūnī appreciated sacrifice for the views on the part of the scholars and would go forward to respect such men of science One such example of Socrates he gives in Greek science, and then he comments "The Hindus had no men of this stamp both capable and willing to bring sciences to a classical perfection Therefore you mostly find that even the so-called scientific theorems of the Hindus are in a state of utter confusion, devoid of any logical order, and in the last instance always mixed up with the silly notions of the crowd, e g immense numbers, enormous spaces of time, and all kinds of religious dogmas, which the vulgar belief does not admit of being called into question Therefore it is a prevailing practice among the Hindus *jurare in verba magistri*, and I can only compare their mathematical and astronomical literature, as far as I know it, to a mixture of pearl shells and sour dates, or of pearls and dung, or of costly

crystals and common pebbles Both kinds of things are equal in their eyes, since they cannot raise themselves to the methods of a strictly scientific deduction "

With such a keen eye for scientific observation, it was not difficult for al-Bīrūnī to discover the real cause of differences between the Muslims and the Hindus, and why it seemed impossible to him that these two human groups would sink their differences in course of time The turn of succeeding events have borne out the prediction of al-Bīrūnī Today we may ponder over them once again But here al-Bīrūnī gives two more historical reasons as applicable to his time

"In all manners and usages they differ from us to such a degree as to frighten their children with us, with our dress, and our ways and customs, and as to declare us to be devil's breed, and our doings as the very opposite of all that is good and proper By the by, we must confess, in order to be just, that a similar depreciation of foreigners not only prevails among us and the Hindus, but is common to all nations towards each other I recollect a Hindu who wreaked his vengeance on us for the following reason —

"Some Hindu king had perished at the hand of an enemy of his who had marched against him from our country After his death there was born a child to him, which succeeded him, by the name of Sagara On coming of age, the young man asked his mother about his father, and then she told him what had happened Now he was inflamed with hatred, marched out of his country into the country of the enemy and plentifully satiated his thirst of vengeance upon them After having become tired of slaughtering, he compelled the survivors to dress in our dress, which was meant as an ignominious punishment for them When I heard of it, I felt thankful that he was gracious enough not to compel us to Indianise ourselves and to adopt Hindu dress and manners

"Another circumstance which increased the already existing antagonism between Hindus and foreigners is that the so-called Shamaniyya (Buddhists), though they cordially hate the Brahmans, still are nearer akin to them than to others In former times, Khurāsān, Persia, Iraq, Mosul, the country up to the frontier of Syria, was Buddhistic, but then Zarathustra went forth from Adharbaijan and preached Magism in Balkh (Baktra) His doctrine came into favour with King Gushtasp, and his son, Isfendiyar spread the new faith both in east and west, both by force and by treaties He founded fire-temples through his whole empire, from the frontiers of China to those of the Greek empire The succeeding kings made their religion (i e Zoroastrianism) the obligatory state-religion for Persia and Iraq In consequence, the Buddhists were banished from those countries, and had to emigrate to the countries east of Balkh There are some Magians up to the present time in India, where they are called *Maga* From that time dates their aversion towards the countries of Khurāsān But

then came Islam , the Persian empire perished, and the repugnance of the Hindus against foreigners increased more and more when the Muslims began to make their inroads into their country"

This last information of al-Bīrūnī needs to be properly examined The persistence *of historical hatred is not unlikely What al-Bīrūnī says about the Maga*, is attested in the contemporary inscriptions They have been incorporated as Maga Brahmans in Gujarat

Al-Bīrūnī paid a visit to the country in the most tense period when recurrent invasions by Sulṭān Maḥmūd of Ghaznah had created emotions and feelings that were not free from prejudice Al-Bīrūnī had himself been compelled to leave his home country in consequence of such a war, but here in this country he was faced with a people who had not only suffered defeat but who were on the verge of defence to save themselves, their social and moral values, their ideals and their civilisation Military defeat was no doubt worse but challenge to the Hindu civilisation was worse still What was the response by the Hindus? Al-Bīrūnī's answer has been noted above It is withdrawing to oneself for self preservation—a characteristic Hindu attitude—to be closing their ranks from within and shutting away the advancing Muslim society Instead of meeting the challenge openly and squarely, the Hindu society fell back upon its old path of tradition and tried to preserve it by keeping it away from the touch of the Muslims Such a passive response does not speak of a buoyant progressive society It indicates a decadent order of things Al-Bīrūnī could not see the signs of such decadence as some modern Hindu scholars have also not been able to appreciate the situation Explanation can be found for all static conditions of life as we find in the then Hindu society Here is what al-Bīrūnī says about some unreasonable practices by the Hindus To him all such unfamiliar ways and ideas were strange and peculiar to the Hindu society With this one remark he shuts his eyes from the many inconsistencies that he noted in the society

What was the range of al-Bīrūnī's knowledge and of what kind of people was he talking and to what particular region such people belonged? Although in his book he talks of the Hindus in general, yet he has himself distinguished between the views of the Brahmans and the practices of the common man In many a place he has shown an inclination for preferring the opinion of the Brahmans although in a few cases he alludes to the popular practices With these few exceptions, al-Bīrūnī's book mainly deals with the views, ideals, philosophy, religion and practices of the educated Brahman class, whom we can generally understand by the phrase Hindu pandits Such Hindu pandits he actually met during his sojourn in the country, and the country for him denoted those areas which were then within the empire of the Ghazni Sulṭāns He explicitly mentions places like Multān, Peshāwar, Rajori, Nagarkot, which he seems to have paid a visit and spent some time There is no definite evidence for his stay in the present city of Lahore The way in which he talks of *Mandakukur* as the capital of

Lahore suggests that he was deriving his material from hearsay or from literary tradition rather than from his personal experience In any case the Hindu Pandits, about whom he was talking need not be the representative of the entire class of the Brahmans from the whole of South Asia Such Pandits came from a limited geographic region and therefore al-Bīrūnī's observation must apply to that region alone It would not be unreasonable to say that al-Bīrūnī's account is more pertinent to the areas that fall within the Indus region, i e within the present territorial limits of Pakistan It can hardly be perfectly true of the Ganges Valley much less of South India The *Indica* of al-Bīrūnī should properly be understood as an account of the Hindus who were then living within the bounds of the Ghazni empire It is the story of the Hindus on the eve of a new Muslim conquest initiated by the Turkish invaders when Islam spread throughout the length and breadth of the Indus region

It is possible to assess the range of al-Bīrūnī's knowledge when he was writing this *Indica* He himself informs "I have already translated two books into Arabic, one about the *origins* and a description of all created beings, called *Samkhya*, and another about the emancipation of the soul from the fetters of the body, called *Patanjali* These two books contain most of the elements of the beliefs of the Hindus, but not all the single rules derived therefrom I hope that the present book will enable the reader to dispense with these two earlier ones, and with other books of the same kind, that it will give a sufficient representation of the subject, and will enable him to make himself thoroughly acquainted with it" Both these works are related to metaphysics In the present book al-Bīrūnī adds only from the (*Bhagvad*)) *Gita* to the information collected from the earlier two works Later he gives a list of the following schools of metaphysics—*Gauda* (*Pada*), *Samkhya* of Kapila, *Patanjali*, *Nyaybhasha* of Kapila, *Mimamsa* of Jaimini, *Laukayata* of Brihaspati and *Agastyatama* of Agastya Usually the classic pattern of the Hindu philosophy includes six schools, called *Shad-Darsana* Although al-Bīrūnī's first quest in respect of the Hindu learning seems to be in the philosophic field, he does not appear to have mastered all the six systems

Another test for judging al-Bīrūnī's knowledge could be made by a critical examination of the materials contained in the chapters on literature His account begins with the *Vedas*, which certainly he was not allowed to read All that he writes about them, is derived from the oral information obtained from the Hindu Pandits As the *Vedas* were out of bounds for him, he could not get into the proper order of the next course of study and accordingly we do not find a mention of the *Vedangas* although later he does refer to a few of them After the *Vedas* he adds in his list the Puranas, and he frankly admits "In the following I give a list of their names, as I have heard them, and committed them to writing from dictation" Again he says, "Of all this literature I have only seen portions of the *Matsya*, *Aditya* and *Vayu Puranas* Another somewhat different list of the *Puranas* has been read to me from the *Vishnu Purana*" His

next reference is to the *Dharma-Sastra* literature under the title of *Smriti*, of which he gives a bare list of twenty works without any comment That is why he separates the following books from the above list without relating them one with the other but makes a candid comment "Further, there are the books of the six pupils of Vyasa, viz Devala, Sukra, Bhargava, Vrihaspati, Yajnavalkya and Manu The Hindus have numerous books about all the branches of science How could anybody know the titles of all of them, more especially if he is not a Hindu, but a foreigner"

Al-Bīrūnī next speaks of the books on metaphysics, already given above To this list he adds *Vishnu-dharma* but he does not talk at all of the famous South Indian dialectician Sankaracharya This is followed by a summary list of the contents of the *Mahabharata*—one of the Hindu epics—which al-Bīrūnī appears to have known only from oral information Of the *Vedangas* he mentions only three types - grammar (*Vyakarana*), metrical literature (*Chhandas*), and astronomy and astrology (*Jyotisha*) He gives a detail of the metrical system probably because he was himself interested in it But the most favourite field of al-Bīrūnī is astronomy He gives the full list and comments "Up to the present time I have not been able to procure any of these books save those of Pulisa and of Brahmagupta I have commenced translating them, but have not yet finished my work" Of the minor literatures like *Karana*, *Tantra* and *Jataka*, he shows some acquaintance and says "Varahamihira has composed two Jatakas, a small and a large one, the latter of these has been explained by Balabhadra, and the former I have translated into Arabic" At the end he refers to the Arabic translation of Charaka's medical treatise and several renderings of *Panchatantra*

If we now sum up his information on literature, we find him enumerating the *Vedas*, *Puranas*, *Smritis*, metaphysics, one of the epics, only three *Vedangas*, and minor literatures like *Karana*, *Tantra*, *Jitaka*, medical treatise and *Panchatantra* This order of al-Bīrūnī's narration is not strictly in line with the Hindu system Usually we have the *Vedas* and then the *Vedangas* Other fields are added subsequently But the place which al-Bīrūnī gives to the *Puranas* suggests a change in the emphasis either on the part of the Hindus or that of al-Bīrūnī It is possible that this way of narration follows the particular practice observed by the Hindu Pandits with whom al-Bīrūnī came across As much of his information was derived from oral communication, he must have followed the order given to him by his informants If this is so, this way of narration is likely to be the system followed in the common educational institutions of the time Al-Bīrūnī's range of knowledge was thus limited to the particular interest shown by the Hindu Pandits

A third testimony about al-Bīrūnī's knowledge can be had from the detail of the subjects given in the *Indica* itself More than half the book of al-Bīrūnī is devoted to cosmology, astronomy and astrology, the material for which he derived from the *Puranas* and from the *Siddhantas*. All this material we have

omitted from our edition as we have limited our discussion only to cultural history In fact we are not competent to discuss his theories in these fields From the same sources he has derived his material for the physical geography, for the Hindu religion, beliefs and practices, festivals and fast days, pilgrimages, and holy rivers and cities, and Hindu eras It is only in philosophy and astronomy that he has made additions from other sources His material on Hindu society appears to have been derived from the same books However, his focus is on the Hindu upper class with an emphasis on theistic cults and his scope is limited to the Vaishnava school of thought Does this mean that al-Bīrūnī had preference for this sect? It does not appear to be so Al-Bīrūnī had no particular choice On the other hand his account mirrors the situations he saw If this is true, al-Bīrūnī's version represents a preponderance for Puranic form of religion and beliefs among the Hindus that he met Such a conclusion would not be unjustified in view of the present research that points to the same direction It is possible to go a step further and say that al-Bīrūnī's own account follows the details of the *Puranas* except the *Itihasa* (dynastic history) portion, which has been omitted by him and substituted by a long description of astronomical concepts and also an addition of some portion of metaphysics However, it would be wrong to say that al-Bīrūnī is only rendering the *Puranas* in his own version He has many personal observation to make and his method of enquiry has yielded the fruitful material which he could usefully contribute to the enrichment of learning known to his Muslim compatriots The value of the book is none the less reduced today It is equally important for us as it throws sufficient light on the contemporary Hindu society, the society which has grown old by A D 1030

What was the impact of al-Bīrūnī's book on his compatriots? The answer has nowhere been given One thing is certain that it did not lead to the foundation of a Muslim school for the study of the Hindus nor do we find any other work of equal importance from the pen of the Muslim scholars Was it due to the abhorrence of what the Muslims could learn from the Hindus? The Muslims up to the time of al-Bīrūnī did not mind learning any useful subject from any source That is why al-Bīrūnī chose to write on this subject, on which there was only a general information to the Muslims But the way in which this knowledge remained static suggests that there was some inherent lukewarmness to this source It may have been due to lack of cooperation on the part of the Hindus

AL-BĪRŪNĪ'S INDIA*

PROFESSOR A M A R FATIMI

THE writer commences his paper with a brief account of al-Bīrūnī, quoting the author of Hundred Great Muslims which pays tributes to Sulṭān Maḥmūd's patronage of learning Sir Jadu Nath Sircar, the Indian historian, is also quoted as saying that few know physics and metaphysics Among these few the greatest in Asia was al-Bīrūnī, at once a philosopher and a scientist and pre-eminent in both these two seemingly incompatible fields But the real credit, according to the writer, goes to the Western Orientalists who studied al-Bīrūnī with greater devotion Then he proceeds to give a frame work of subjects of the 80 chapters of al-Bīrūnī's book 'India'

With regard to Sachau's commentary on India, the writer disagrees with his "Community of Mishaps" theory which inspired al-Bīrūni to write 'India' because he suffered under Sulṭān Maḥmūd's occupation of his country, and Hindus also suffered from the same cause, and this resulted in his feelings of sympathy for the Hindus If this theory was advanced at one place, a dissimilar conclusion is derived at another by Dr Sachau when al-Bīrūnī has been termed as "still he was a Muslim, and taking an occasion for pointing out to the reader the superiority of Islam over Brahmanic idea " And then again his remark that "with all this, his (al-Bīrūnī's) recognition of Islam is not without tacit reserve He does not attack Islam, but he attacks the Arabs " And surprisingly enough in his Annotation in the 2nd volume (page 331) he admits that "it shows that the religioūs policy of King Mahmūd, the great destroyer of Hindu temples and idols, under whom al-Bīrūnī wrote, must have been so liberal as to be rarely met within the annals of Islam " All these remarks point out to the tendency of this western scholar to bend facts to fit on to a hypothesis

In real fact, according to the writer, it is the quest for learning and knowledge which led al-Bīrūnī like other Muslim scholars to dedicate themselves into this search Al-Bīrūnī drew largely from Greek, Persian and Indian sources to provide authentic first-hand information, and his "Fi Taḥqīq Mā Li al-Hind" or in short the History of India was written in this spirit of endeavour His comparative study of the Hindu institution with those of the Greek, the Persians, the Jews, the Christians and the Muslims is a significant achievement of al-Bīrūnī made possible only because of the huge reservoir of knowledge acquired by him

*Original paper is in Urdu This is an English abstract

STUDY OF AL-BĪRŪNĪ'S LIFE AND WORKS IN THE SOVIET UNION

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FIRST mention of al-Bīrūnī's life and works appeared in Russian scientific journals in the late 18th century (1) In the 19th century such outstanding Orientalists as N V Khanykov and V V Grigoriev turned to al-Bīrūnī's works in connection with their own research In 1889, V V Rozen wrote about al-Bīrūnī, giving a comprehensive estimation of his personality and works and of the place they occupy in the history of world culture (2) At the beginning of our century various aspects of al-Bīrūnī's scientific legacy were studied by K A Inostrantsev, K I Zaleman, A N Samoilovich and V V Barthold (3) At that very time came out the works about al-Bīrūnī written by I Y Krachkovsky (4)

Works by Russian orientalists, which appeared in the late 19th and in the early twentieth centuries stressed the significance of al-Bīrūnī's genius for the history of world science and culture Special mention was made of the importance of al-Bīrūnī's works for the study of the history and culture of South Asia Thus academician V V Rozen eighty-four years ago wrote about al-Bīrūnī's book "Indica" "It is the only literary monument of this kind and nothing can be compared with it in ancient and medieval scientific literature of the West and East "(5)

Soviet orientalists also study very thoroughly the life and works of al-Bīrūnī Suffice it to say, that only in the post-war period three hundred works about al-Bīrūnī have been published in the U S S R A collection of al-Bīrūnī's works in five volumes, translated into the Russian and Uzbek languages, have appeared All in all works of al-Bīrūnī have been published in my country about twenty times

In a short report it is very difficult to even enumerate all the works about al-Bīrūnī, which have been printed in the Soviet Union Generally speaking, the study of al-Bīrūnī or the al-Bīrūnī studies have become in my country an individual branch of the Oriental Studies There are four main directions of

the Bīrūnī studies The first is connected with the scientific critical publication of al-Bīrūnī's texts,(6) the study and comparison of manuscripts, the reconstruction of genuine author's texts and their translation from the Arabic language, in which al-Bīrūnī wrote, into the Russian, Uzbek and other languages of the peoples of the U S S.R

The second refers to the study of al-Bīrūnī's scientific legacy in history, philosophy, ethnology and other humanities

The third deals with the study of al-Bīrūnī's works on natural sciences (astronomy, mathematics, physics, geology, mineralogy, pharmacology and others)

The fourth is concerned with the study of life and world outlook of the great scientist, his place in the world science and the popularization of his life and works

Although the first translation of al-Bīrūnī's texts were made in Russia by N V Khanykov already in 1860, a wide variety of his works began to be translated only in the 1940's when the translations made by S Volia and A M Belenitsky appeared In the fifties this work was continued by M Abdurrahmanov, Y N Zavadovsky, A Rasulev, A E Shonidt and M A Salie Especially great effort in translating and publishing al-Bīrūnī's works has been done by the Institute of Oriental Studies of Uzbekistan Academy of Sciences in co-operation with the Orientalists of Leningrad and Moscow In 1957—1973 they printed in Russian and Uzbek a five-volume collection of al-Bīrūnī's texts Besides the above-mentioned scholars there were others who took part in this important endeavour They are I Abdullaev, A Faizullaev, A B Khalidov, V I Erman, V I Belyaev, V A Livshits, Y Hakimjanov, I Jalalov, P G Bulgakov, A Ahmedov, S Kh Sirajinov, B A Rozenfeld, G P Matvievskaya, A K Arends, U I Karimov, S A Azimjanova As is known, according to the decisions of the XXV International Congress of Orientalists of 1960, the Institute of Oriental Studies of Uzbekistan Academy of Sciences, named after al-Bīrūnī, has been made the co-ordination centre of study of the scientific and literary legacy of of al-Bīrūnī

Al-Bīrūnī's and Ibn Sīnā's correspondence has been published in a separate volume, as well as al-Bīrūnī's treatises on mathematics and astronomy (7)

Orientalists of Uzbekistan, Tajikistan, Moscow and Leningrad are preparing for publication critical texts of all al-Bīrūnī's works in the language of the original i e, in Arabic

A certain amount of work has been done by Soviet scientists to study al-Bīrūnī's legacy in the humanities Thus, S A Azimjanova has compared the facts on history and culture of South Asia found in the texts by al-Bīrūnī and Bābar K Z Ashrafyan has made a critical study of al-Bīrūnī's texts on Indian castes M Baratov has published several articles in which he shows that

al-Bīrūnī's works can be used as a source for studying the history of Indian philosophy V G Erman made a research of Indian sources which al-Bīrūnī used in his works K Shahniyazov in his articles has shown the significance of al-Bīrūnī's works for the study of ethnology of the peoples of Orient An interesting article on al-Bīrūnī's works and the toponymy of Orient has been written by H Hasanov The importance of al-Bīrūnī's works for the study of the history of Central Asia, Iran and Afghanistan has been subject of articles by A K Arends, A P Qayumov, A Irisov, J Qadirova, A M Mandelshtam, B A Kolchin and others

U I Karimov and A Rasulev have written a number of articles on al-Bīrūnī's philological works and poems Soviet scientists also did a great amount of research into the epoch when al-Bīrūnī lived and worked See, for instance, the articles by I Y Krachkovsky, S P Tolstov, A A Semenov, Y G Gulamov, V M Masson

As it was mentioned above, one of the al-Bīrūnī studies branch is devoted to his contribution to the natural sciences The importance of al-Bīrūnī's mathematical work and his general contribution to mathematics are dealt with in the work by Soviet scholars B A Rozenfeld, S A Krasnova and M M Rozhanskaya Kh U Sadykov has published an article on al-Bīrūnī's mathematical geography Researches on al-Bīrūnī's mathematical works have been also published by D M Mamodov, L A Karpova, E G Qasymova, A Abdurrahmanov, G P Matvievskaya, A P Yushkevich and others

Al-Bīrūnī's works on astronomy have been dealt with in the articles by Kh U Sadykov, G D Jalalov, G Y Umarov and V P Shcheglov Scientific legacy of al-Bīrūnī in geology and mineralogy has been studied by O I Islamov, A M Akramhojaev, I P Mikhalevich, I I Lemmlein, N I Leonov, K V Kostrin

In pharmacology by U I Karimov and S I Mirzaev, in physics by J Zakrilaev and so on

It should be noted that Soviet scholars have paid much attention to the study of al-Bīrūnī's outlook and philosophy Especially industrious and fruitful in these studies were I M Muminov, B M Kedrov, V Y Zahidov, S N Grigoryan, A D Sharipev, M A Usmanov, P I Bulgakov, A F Faizullaev, R N Nasirov

Much is being done in the Soviet Union to popularize the scientific legacy of al-Bīrūnī

In commemoration of millenary of al-Bīrūnī's birth special scientific sessions were held in Moscow, Leningrad, Tashkent, Dushanbe and other scientific centres, collections of works on his life and activity have been published Popular biographies of al-Bīrūnī and essays on his scientific legacy have been written by A M Belenitsky, A Irisov, I I Rainov, A A Semenov

Special note should be made of the monograph "Life and Works of al-Bīrūnī" published in 1972 by P I Bulgakov A bibliography of works about al-Bīrūnī by Soviet scholars has been printed by B V Lunin

In October 1967, the State al-Bīrūnī Prize has been established in Uzbekistan It is awarded for outstanding works in science and technology For the past six years many scientists have been given this prize

Al-Bīrūnī's name is among the names of the greatest scholars of all countries and peoples He made a tremendous contribution to many natural sciences and the humanities The millenary of his birth is a great occasion not only for the peoples of Central and South Asia, where he lived and worked, but for the whole mankind Therefore Soviet scholars are glad that the 1000th anniversary of his birth is marked not only in the Soviet Union but in many other countries as well We are glad that this jubilee is being celebrated by the scholars of friendly Pakistan We are sure that the Conference organized by Pakistani scholars under the auspices of Hamdard National Foundation will become a great contribution to the study of al-Bīrūnī's life and legacy We are sure that this Conference will help in strengthening the fruitful co-operation between the scholars of the Soviet Union and Pakistan, between the scholars of all countries of the world

In conclusion I should like to express my deep appreciation to our Pakistani colleagues for the very good organization of the Conference

NOTES

(1) "Biblioteka uchenaya" Tobolsk, 1793 (Part II, pp 142-143).

(2) "Zapiski Vostochnogo Otdeleniya RAO", Vol III, St P, 1889, s 146—162

(3) V V Barthold,—"Sachineniya", Vol I, MOSCOW, 1963, "Zhurnal MNP", St P, 1911, N 8, s 284—318 "Izvestiya IAN", Vol VI, N 14, St P, 1912, s 861—870

(4) "Hristianskij Vostok", Pt II, St P 1915, s 225—242, I V Krachkovsky,—"Sochineniya", Vol IV, M—L, 1957, "Ocherki poisterii russkoi arabistiki", M—L, 1950

(5) "Zapiski Vostochnogo Otdeleniya RAO", Vol III, St P, 1889, s 147

(6) Al-Bīrūnī, Vol I (Chronology), Tashkent, 1957,
Vol II (India), Tashkent, 1963,
Vol III (Geodesy), Tashkent, 1966,
Vol IV (Pharmacognosy), Tashkent, 1973,
Vol V (Canon of Mas'ūd), Tashkent, 1973

(7) Al-Bīrūnī, Mineralogy, Leningrad, 1963 etc

PORTRAITS OF TWO SAVANTS AND HUMANISTS—BĪRŪNĪ AND ALBERT THE GREAT

DR LOUIS GARDET

LAST September, during the Teheran Conference, I presented some observations on the "philosophical insights" which break through in many of the works of Abū al-Raihān I referred not so much to his correspondence with Ibn Sīnā, but rather to the *Tahdīd nīhāyah al-amākin*, and above all to the *Āthār al-bāqiyah* (1) and the *Taḥqīq* (2), two works of capital importance, perhaps amongst the best-known today As you are well aware, during the last century they were translated into English by C E Sachau, and given the following titles "The Chronology of Ancient Nations", and "Alberuni's India" (3) I would add that I chose as examples three themes concerning at one and the same time cosmology and the philosophy of nature the non-eternity of the world, nature (*ṭabī'ah*) and secondary casualty, matter (*hayūlah* and *mādah*) in relationship to form (*sūrah*)

It so happened that, while I was endeavouring to get a clear grasp of these notions, suggested by certain passages of the *Tahdīd*, the "Chronology" and "*India*", it was as if the portrait of al-Bīrūnī was being sketched before my eyes His intellectual, and I would even say spiritual, personality became more and more clear and, allow me to say so, more attractive also This personality could not but call to my mind a great thinker of the Latin Middle Ages who lived two centuries after Abū Raiḥan

Should one speak of a direct influence? Hardly, for Bīrūnī was much less known to the Latins than he deserved to be It is primarily, I would think, a question of a meeting of minds, which examine the work of the Creator with the same respect for what *is* and the same concern for scientific investigation This theme has since been constantly haunting me I would like to discuss it with you today My reflections fall into the category, not of historical research—a critical examination of texts in order to trace eventual borrowings or dependence —but rather of comparative typology I hope to prove that there can be form

of communication between people who have the same love for and yearning after what is true, *al-ḥaqq*, both Truth and Reality It should be noted that we are dealing with two very different cultural spheres These differences, however, as is well known, did not prevent the Christian Middle Ages from receiving from Arabo-Muslim thought an indispensable contribution in the realm of philosophy But the socio-economic conditions of the period made it extremely difficult for the Latins to see such people as al-Fārābī, Avicenna and Averroes in their proper context Had this been possible, they would probably have been attracted to many other thinkers in Islam, and I think that Bīrūnī would have been one of the first To become aware of this today does not seem to me to be without significance for what we all desire, namely to promote dialogue between different cultures

A preliminary remark Bīrūnī lived in the 10th-11th century (4th-5th century of the Muslim Era) The Christian thinker whom he calls to my mind is Albert of Lauingen who lived in the 13th century His contemporaries, who liked giving surnames, called him Magnus or Magister, Albert the Great or Master Albert Abū Raiḥān, in so far as he was known, also earned the title of Magister, Master al-Bīrūnī So, two centuries separate these two figures but this lapse of time was necessary for the West to rise to the cultural level of the East

In point of act, the *dār al-Islām* of al-Bīrūnī's epoch was noted for its great culture and brilliant humanism It corresponded to the end of that period in the West which can be called the "Iron Centuries", a period which saw the rather hesitant dawn of the renewal appearing on the horizon The Latin 11th century had its theologians, such as Anselm of Canterbury, but it did not see, because it could not, the type of humanist-investigator exemplified in a remarkable way both by Bīrūnī and Albert This type is certainly not the necessary product of conditioning in time and space, but a particular socio-cultural environment is required for it to develop

The intellectual and spiritual silhouette of Abū Raiḥān, as he appears in some of his writings, will provide a useful framework for the present reflections I wish to look at him from three angles that of the relationship between faith and science, that of the relationship between science and philosophy, and that of the use of philosophy itself

Harmony between Science and Faith

To put it briefly, Bīrūnī, the great savant dedicated to research, was at the same time a true believer His faith as a Muslim cannot be called into doubt. He has no hesitation in declaring it openly on many occasions (4) Of course, he quotes Abū Bakr Ibn Zakarīya Rāzī and takes into account certain of his analyses But, as opposed to Rhazes, his whole world vision, expressed as much

in his considerations on geology as in his comparative studies of civilisations, is one long praise of God, the absolute Creator and only Eternal One What is more, with Bīrūnī it is not just a question of a savant who happens to be a believer Not only is there no gap between Bīrūnī's faith and science, but his spirit of scientific research springs from, and is rooted in, his faith in God Moreover the research has as its final term God, the Master of Universe Bīrūnī fulfils, and how competently, the oft repeated Qur'ānic injunction "Reflect upon the Signs of the Universe" The passage in the *Tahdīd* where he wishes to prove the non-eternity of the world is one example amongst others(5)

Now, this harmony between faith and science is found along almost the same lines in Albert the Great Had he been able to know it, Albert would have liked the passage of the *Tahdīd* in which Bīrūnī, on the subject of creation, invokes the concordant witness of the 'People of Book' He would doubtless have appreciated the metaphorical interpretation of the Seven Days of creation of Genesis which Bīrūnī, as Augustine before him, understands as periods which are not subject to historical measurement(6)

Abū Raiḥān, to tell the truth, is essentially a savant in the modern sense of the word He is interested in the exact sciences, of whatever kind In some ways, he is far in advance of his time, even in advance of the knowledge Albert the Great could acquire in the 13th century If for both of them science and faith are in harmony, I have nevertheless to underline a certain cleavage It is his scientific research, conducted in a context of faith, which leads Bīrūnī to the remarkable philosophical insights that are scattered throughout his works It leads him to a position of realism with regard to knowledge and to a true appreciation of the efficacy and subordination of secondary causes However, he is not first and foremost a philosopher Even if his philosophical treatises, so called because of the titles they bear(7), become available some day, I am confident that this judgement will not need modification Bīrūnī is much more the savant who examines what the philosophers have to say, who is capable of utilising their vocabulary and of understanding their problems, but who only does so in so far as it provides him with a useful tool for his own investigations

Albert, on the other hand, is above all a philosopher and a theologian His constant concern is the relationship between philosophy and theology This does not interest Abū Raiḥān, a fact which can easily be explained by the difference in cultural climate between Islam and Christianity But what is remarkable about Albert, is that there is no question of his using a philosophy already elaborated Indeed in certain areas the scientific method of induction seemed to him to be indispensable for philosophical research itself This is something sufficiently rare in his time and in his milieu to be worth noting This is where he and Bīrūnī meet, and this is why they express themselves in similar fashion So the comparison I wish to draw will be first of all between the two as savants, and then between them as philosophers.

Science and Philosophy

Albert was fully aware that the philosophy of nature must be based on scientific research Mathematics and physics seemed to him to be as necessary as logic He cannot be called a mathematician nor a physicist, but he was always willing to make use of past progress Yet he was not a mere compiler of material "He explains, comments, develops", writes E Gilson of Albert, "and puts himself to a real work of restoration" What is more, in those domains which will be given the name of natural history, he does not hesitate to engage in personal research He shows that he has a keen sense of observation, he suggests experiments, so much so that he manages "to contribute new knowledge to the science of zoology"(8) Though, as is only natural, he writes a commentary on Aristotle, and another on the *Sentences* of Peter Lombard, he is much more than a mere commentator of the Ancients Albert makes an original contribution and opens up the way for future syntheses Yet he has left us no treatises on science, but rather treatises and compendia (*Summae*) of a philosophico-theological nature In these one can find, here and there, material drawn from the natural sciences, used as basic data and integrated into a new whole His method would lead us to the conviction that the philosopher, and so also the theologian (who necessarily makes use of philosophy to understand the faith), cannot accomplish their task unless they take stock of the developments of science in their own age

Bīrūnī's intellectual make-up is quite different By temperament, he is given to research in the exact sciences From the age of seventeen he knew how to determine the latitude of a place Four years later he perfected the graduated circle he was using Astronomy, geodesy, mineralogy, botany, ethnology, there is no domain which does not interest him and to which he has not made some contribution What I have called his philosophical insights are nothing but the spontaneous philosophy of the savant, enlightened by his faith, who reflects on certain major themes Deductions and intuitions of the mathematical sciences, experiments and inductions of the physical and natural sciences, each in its own sphere, are made continuous use of by Bīrūnī

It is not necessary for me to enumerate the precise areas in which he helped to increase the body of scientific knowledge Others, more qualified than I am, will do this in the coming days But there are two perspectives which he rendered illustrious, and I would like to underline how apt they were to further philosphical reflection There is first of all his contribution to the mathematical sciences, what Louis Massignon called "projection of numbers in discontinuous duration , the study of singular ordinal numbers having experimental specificity, the algebrisation of mathematical imagination"(9) Was Bīrūnī helped in this by the atomism of certain *Mutakallimūn*, or more directly by that of Ibn Zakarīyā' Rāzī? This possibility cannot be excluded What is certain is that the intuitive side of the mind, which plays such an important role in mathematics,

was very marked in Abū Raiḥān It is a great pity that the philosophy of the epoch, as much in Islam as in Christendom, remained upon these subjects at the stage of word by word commentaries on Aristotle and his commentators It must be remembered that Aristotle was certainly more a physicist than a mathematician If these Bīrūnian perspectives, open to discontinuity, could have been adopted by a philosophy of being and of the act of being, much of the separation which came about in modern times between sciences and philosophy could have been avoided

The second contribution of which I am thinking is hardly more than an *obiter dictum* in Bīrūnī's immense output But to my mind, it is very suggestive In his book on India, when reflecting upon Indian cosmologies(10), he notes, and proves, that a heliocentric view of the world would be in no way illogical, and could therefore be compatible with faith in creation, just as much as Ptolemy's geocentrism Toward the end of his life, no doubt because of the limitations of astronomy in his time, he declared himself to be in favour of geocentrism Yet this pre-Copernican insight into the logical possibility of heliocentrism could have helped to prevent much floundering and hasty harmonisation ("*concordismes*"), and even perhaps the unfortunate Galileo affair

To conclude this section I would say this Bīrūnī the Savant and Master Albert the philosopher-theologian were born to understand each other It was as if Albert was waiting for the lines of research opened up by Bīrūnī Circumstances did not allow him to be in contact with foreign civilisations and languages, as was the case with Abū Raiḥān the Sanskrit scholar Yet there is no doubt that the integration of sciences, which was what he required of philosophy, would have been facilitated and furthered, if he had been able to make use of the body of scientific knowledge acquired by his great predecessor Their common respect for the work of the Creator, and their common realism in epistemology, would have given particular fruitfulness to a meeting, had this been possible despite the difference of time and place, between the philosopher-theologian and the savant who had unified faith and scientific knowledge

Philosophical Independence

Could it not even be affirmed that the savant had a word for the philosopher on the subject of philosophy itself? Albert was a philosopher only because he was a theologian This being so he tended to accept from his teachers a philosophy conceived of as a rich compound of Plato and Aristotle, the Greek commentators of the latter, and the most important contribution of the *Falāsifah* of Islam, especially Avicenna Albert's penchant for Platonism is well-known His disciple, Thomas Aquinas, had to correct it by setting it within its proper context Perhaps Albert derived it from the *faylasūf* Ibn Sīnā When, in his treatises and philosophical commentaries, he comes up against the broad lines of

avicennian cosmology, it is with a certain reverence that he summarises the main points· the theory of emanation, the celestial spheres and their triads, the role of the *Intellectus agens*(11) But in several places he gives the impression that he is not fully convinced by the arguments which he is summarising His respect for Avicenna and his openness towards all serious striving for the truth prevents him from engaging in any immediate discussion It is only in his own personal *Summa theologica*, when he is readdressing himself to the same questions, that he deliberately sets aside everything in Ibn Sīnā's cosmology which is opposed to a world-view centred on free, gratuitous, divine creation

It is rather remarkable that, in this respect, Bīrūnī, the savant, gave proof of greater independence Of course, it is true that he had a much better knowledge of the cultural context of the eastern *Falāsifah* He would surely have been very surprised if someone had told him that the avicennian system was the Islamic philosophy Ibn Sīnā, seven years his junior, was a philosopher whom he deemed worthy of consideration, but he was far from accepting all his theses Witness the famous exchange of letters, whose tone is sometimes rather sharp, between the twenty-year old Ibn Sīnā and the twenty-seven-year old Abū Raiḥān Bīrūnī discusses and refutes a number of Ibn Sīnā's arguments, and attacks, over and beyond his immediate interlocutor, what he considers is the method of Aristotle himself

It is scientific questions that Bīrūnī raises, but he does not try to avoid their philosophical implications discussion on the law of gravity, the four elements, the celestial spheres, leads to further discussion on the non-eternity of the world (on which Bīrūnī refers to Philopon), and the possible existence of "other worlds" Should we regret that Bīrūnī himself felt no inclination to treat these questions in an explicitly philosophical context? No doubt he thought that he could answer them conclusively on the basis of scientific induction, without always being aware of the limitations of this method Often he declares that he agrees with Aristotle's conclusions, but he will not accept his method or manner of approach (12) He was perhaps beginning to discover a more authentic Aristotle than the one presented by the commentators

Bīrūnī's criticism and arguments could not put in jeopardy the ingenious philosophical synthesis which Ibn Sīnā was to leave to posterity, nor his contribution to science, to medicine and astronomy for example However, they help us to become aware of certain cracks in this philosophical edifice which were there from the very beginning, and to show that, without refusing the dynamic aspect of the analyses in question and their grasp of reality, other explanations are possible, explanations which centre on "the act of being" rather than on "the state of being" (ḥāl al-wajūd), on emanation which is creative in the strict sense of the word, rather than on creative emanation which operates according to "willed necessity"

At this point, I would like to express two regrets First, it is a pity that the debate by letter with the young Ibn Sīnā did not encourage Bīrūnī to make personal use, in his treatment of the philosophy of nature, of certain data which, it seems to me, Abū Ya'qūb al-Kindī had begun to bring to light His own scientific knowledge would without doubt have enabled him to develop them fully Perhaps then the famous controversy of the *Tahāfut* would have been made unnecessary

Secondly, it is sad that Abū Raiḥān's independence of mind was not known to the Latins, especially to Albert In the Latin translations from the Arabic, made in Christian Middle Ages, *falsafah* was presented in a solid block, or rather in two blocks, Avicenna and Averroes They were discussed and argued over, they were above all admired, and rightly so But the price paid is well known, namely the crises, first Avicennian, then Averroist, which scholastic thought had to go through

It was, in point of fact, Master Albert who foresaw, even before Thomas was able to bring greater clarification, how the crises could be overcome without rejecting the greatness of the two *faylasuf-s* and the Greeks whom they claimed to be following However, the inner cohesion of the Avicennian system and the strength of its analyses seem to have hindered Albert to a certain extent in his attempted rectification —Here again Albert and Bīrūnī are one in their liking for constructive criticism The freedom of research which the latter enjoyed, on account of his method of scientific investigation and deduction, would have been of great value to the former also

Specialists of the Latin Middle Ages will perhaps have been surprised that I have chosen to refer to Albert the Great rather than to his contemporary Roger Bacon, known as the "Admirable Doctor" For Roger was, in the West, the great promoter of experimental science, *scientia experimentalis*, of irreplaceable value He was also one of the first to stress the importance of mathematics This is his real title of glory Now, all this is true, and it is probable that judged according to his scientific spirit, he is closer to Bīrūnī than Albert But despite this similarity, there is between them no real union of minds Experimental science becomes, for Roger, the instrument, and perhaps the framework, of a sort of "revealed philosophy" (dating from the time of Adam) The judgements he expresses about his adversaries are very absolute, and the disdain he felt for the great majority of his contemporaries he easily extended to all those whom he called "Saracens"(13) There is no sign here of that openness of mind and sympathy which Bīrūnī showed in exploring India and Indian thought, or which Albert gave proof of in his approach to the *Shifā'* of Avicenna Perhaps I am being unjust to the "Admirable Doctor" The judgement could be more nuanced Yet I think it can safely be said that the fieriness and brittleness of his intellectual temperament prevented Roger from being a man of dialogue like Bīrūnī and Albert.

As I said at the beginning, what I have presented here is not strictly speaking a historical study, but rather an exercise in comparative typology My conclusion is that it *would* have been possible for Albert to have had some knowledge of Bīrūnī's thought This would have been desirable and certainly fruitful It would have made it possible for the "philosophy of being", which was the philosophy of the greatest amongst the Latin medieval thinkers, to integrate into itself in a living manner the methods and conclusions of science This would have prevented modern philosophy in the West from going down so many blind alleys

But unfortunately, Bīrūnī, unlike the *Falāsifah*, was only slightly known to the Latins, and badly known at that It was only at a later date that some of his works were translated These were "certain chapters on marginal questions concerning natural magic, judicial astrology, and the art of talisman making"(14) So much so that Master al-Bīrūnī was thought of in the West as a sort of magician It is amusing to note that the same misadventure befell Albert to whom were attributed, without any justification whatsoever, numerous instructions (often part of popular heritage) on how to make talismans and compose spells The reason is that both of them were ahead of their times The openness of mind which they both showed, and their common taste for research and experimentation were, in their contemporaries' eyes, something rather mysterious

What was not possible in the 13th century can become today Would it not be paying one of the greatest tributes to Bīrūnī to take up once again, starting from his works, the true cultural dialogue which the Middle Ages certainly inaugurated, but could not bring to fruition? Bīrūnī, Ibn Sīnā, Albert, Thomas Aquinas, and several others with them, would raise their voices in harmony This would not simply be in praise of ages past, but to bring clarity to certain series of questions which have become more and more muddled, and elements of solution might be found for many questions of present concern

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(9) Louis Massignon, "Al-Beruni et la valeur internationale de la science arabe", in *Al-Beruni, Commemoration Volume*, reprinted in Louis Massignon, *Opera Minora*, Beirut, 1963, II, p 589

(10) Cf India, I, pp 276-277, and S H Naṣr, *op cit*, pp 135-136

(11) See his Commentaries and also, as an example, his treatise *De Intellectu and Intelli gibili*

(12) For example as regarding the law of gravity, the circular movement of the spheres, etc This "Correspondence", several times studied and mentioned, is now edited in Teheran by Drs Nasr and Mohaghegh

(13) See his Opus Tertium, XXIV

(14) D J Boilot, *Maitre Abūl-Rayḥān al-Berūnī, un precurseur de la science moderne at du dialogue culturel au XI siecle*, M I D E O, vol II, Cairo 1972, p 353

AL-BĪRŪNĪ AND HINDU CULTURE— A POINT OF VIEW*

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COMMENTING on Hindu culture's portrayal by al-Bīrūnī the author defines his impartial qualities and considers him the highest among its interpreters His immense knowledge, scholarship, and his own contributive learning were his great assets when he made these appraisals

Dr Sachau can be considered a great authority in advancing some sound interpretations on al-Bīrūnī's scientific analysis of Hindu culture However he has at times attempted to insinuate a straightforward and honest Muslim as biased and prejudiced, and in this effort he is betraying himself often as narrow-minded His treatment of Sulṭān Maḥmūd of Ghaznah is also unfair in his introduction of *Kit¯b al-Hind*, and contradictory at times, when he praises the gathering of brilliant scholars at his court But just due to the Sulṭān's treatment of Firdowsi, the Sulṭān is criticised as narrow-minded The same changing view he has about al-Bīrūnī, when while praising his deep insight of Hindu philosophy he is also critical of him, saying that "Still he was a Muslim, whether Shia or Sunni cannot be gathered from Indica, and some times takes the occasion for pointing to the reader the superiority of Islam over Brahmanic Ideas" If al-Biruni had any bias to express, the ideal topic would have been on the idol worship which was contrary to Islamic concepts And when Sulṭān Maḥmūd was a deliberate idol breaker, this topic could have formed an important chapter of *Indica* But al-Bīrūnī deals with idol worship only as a religious custom and cites from Greek and Hindu traditions to forward his view that such a worship was essentially to establish a tradition, and to seek mental solace But later on such customs adopted severe proportions of bigotry In terms of caste distinctions he has undoubtedly found it contrary to Islamic concept of equality of men He suffered himself from these trends because the Hindu Brahmins refused to impart their learning to him on the grounds that he was a Muslim, and they stood to become unclean even if his shadow fell on them Having a true scientific bent of mind and disbelieving in all such tendencies which did not exist in his

*Original paper is in Urdu. This is an abstract in English

own religion he had a definite purpose to bring out such distinctive features of their customs, to progress the trend of understanding, which is apparently the sole purpose of his *Indica* He has not only brought this aspect for discussion on Hindu culture but in case of other cultures and religions also wherever he has noticed a tendency to divide people into classes He has even cited on the ancient Iranian culture under Ardeshīr ibn Bābak when his new reforms were aimed at creating four classes of people

It is also wrong on Dr Sachau's part to introduce the differences of 'Arab and 'Ajam and involve al-Bīrūnī in this If this was the undercurrent trend of al-Bīrūnī's thinking he would not have had to take the trouble of visiting numerous places, cities and areas for ten years, learning not only Sanskrit, but various other dialects He could very conveniently sit in Ghaznah and write a book One whole regiment of Sulṭān Māḥmūd was made up of Hindus, and most of his elephant drivers were Hindus Due to Ghaznah's prosperity many Hindus had come to the city and settled there, and they were free to follow their rites, customs and traditions There were Brahmins, Kshatriyas, Vesh and Shudras, and could provide enough material for al-Bīrūnī to write

Al-Bīrūnī's aim was therefore far higher, and his search in India was based on deeper motives of a prodigious scholar interested to contribute wholesomely for greater understanding among the future generations through his scholarly efforts

AL-BĪRŪNĪ'S CONTRIBUTIONS TO GEOGRAPHY*

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ACCORDING to the author, geography was a popular subject among the Muslims of the medieval times due to their interest in trading, environmental conditions of the Arabs, large extension of the Muslim lands, pilgrimage to Mecca and necessity of finding Qiblah, and early contacts of the Muslim scholars with Greek geographical and mathematical works, which all contributed together towards the development of geography and geodesy during one's period Within 200 years of the establishment of Bait al-Ḥikmah in Baghdad in 8th century A D to the times of al-Bīrūnī in the 10th and 11th century A D a great lot of works poured out on various branches of geography like regional geography, mathematical geography, physical geography, cartography etc Al-Bīrūnī brought a new orientation to those contributions, corrected many of the errors in the past works and acknowledged the contributions where due, like a true scientist

In Bīrūnī's *Qānūn al-Mas'ūdī* a number of problems of mathematical geography have been discussed His *Kitāb Tahqiq Mā Li al-Hind* also contains valuable information on regional and physical geography Another of his books *Kitāb al-Tafhīm* deals with cosmogphical, astronomical and geographical topics His other books containing valuable geographical material are *Kitāb al-Tafhīm wa Iḥitrāb*

Al-Bīrūnī believed in the sphericity of the Earth and has also discussed the antipodes To some European scholars of his period these ideas were abhorrent and incredible and they were unable to believe that human life could be possible at the antipodes Al-Bīrūnī also fully understood the phenomena that the polar areas enjoy 24-hour days in summers and continuous nights in winters He fully grasped the obliquity of ecliptics With regard to Earth movement, he rightly viewed its rotation on its own axis, but believed that the sun revolves round the earth But with an open mind he was ready to accommodate Abū Sa'īd Sinjar's suggestion on the possible movement of the earth round the sun

*Original paper is in Urdu This is an abstract in English

He was very adept at fixing the co-ordinates of various places and wrote many articles on the subject

In the field of geodesy al-Bīrūnī's contributions have earned him great distinction His method consisted of calculating the radius of the earth and then using the plex formula to work out the circumferences of the earth The circumference thus calculated was 24779 miles, only 78 miles short of the actual one In case of regional geography, his approach to the subject is by collecting detailed information on the physiography, hydrography, climate, fauna, flora, people, places, towns, commerce, communications, etc He gives ample proof of understanding of the geographic influences His remarks on geological, meteorological and climatological aspects are sound and thought provoking He believed in the southern extension of the African continent and the navigability of the ocean in the south In the field of physical geography, besides discussing the chain of mountain systems in Asia and Europe, his theory regarding the origin of the plains of Hindustan is remarkably close to the modern geosynchlinal concept He makes clear distinction between a gulf, which is a part of sea penetrating inland, and an estuary, which is a part of river at its mouth entering the sea He describes the tidal phenomena and the effect of moon on the ebb and flow of the sea during the various days of the lunar month Other aspects discussed by him are meteorites, clouds, lightning, thunder, snow, hailstorm underground springs, etc , and pointing out their causes

In cartography, al-Bīrūnī fully appreciated the problem involved in transferring the map of three-dimensional and spherical Earth, and flat two dimensional paper Thus he invented stereographic projections In his *Kitāb Tafhīm* he prepared a round map of the world to illustrate the position of the seas, and in another book *Āthār al-Bīqiyah* he devised a method of projection of maps of the sky and the earth He has also drawn many maps of various countries of the known world

The author concludes his paper with the remark that al-Bīrūnī had the ability to apply abstract principles to the particular problems in hand, and his scientific methodology earn him a place among the scientific immortals of all times

EARLY IRANIAN KNOWLEDGE OF PAKISTAN WITH SPECIAL REFERENCE TO BĪRŪNĪ'S WORKS

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THE Irānian plateau, of plains and passes, slopes eastwards to meet the Indus Valley, of flowers and fields So do the people inhabiting it Since times immemorial, the general trend of the migrating men has been to pour down the passes and till the fields And the pouring people hardly know where they are heading for They keep pressing forward—taking decades and centuries—to inch their way to places an invading army may take but a few months to tread on Moreover, they seldom turn to their original lands to tell the folks, if at all any left behind, how the new lands look like The earliest hunters and food gatherers of the Irānian plateau, therefore, had hardly any idea of what lay down in the east

The rise of settlements between the Nile and the Indus changed the situation Man was not only tracking and trekking, but trading also Trade has its tricks—a fair knowledge of ways and wares, means and markets, men and manners, and lands and languages We can safely presume that the Iranians who traded with the settlements of the Indus Valley did know the area, now Pakistan Archaeological evidences, still far from being complete, show contacts between Iranians and Pakistanis as far back as 4500 years ago The traffic was two-way, both on land and sea The knowledge was mutual

Then the great Indus Civilization rose to flower and flourish and so did the trade Evidences of caravans snaking up and down the plateau and ships sailing to and from the coast are increasing with the expansion of archaeological activities in Iran and Pakistan

The mass migration of the Aryans disrupted the trade and perhaps destroyed the knowledge, partially if not totally But the very Aryanization of the plateau and the valley brought the two regions ethnically much closer The traffic

was resumed as soon as the invaders had settled down to work, produce and barter The Aryans introduced horses and camels as beasts of burden and increased the speed and the carrying capacity of caravans

The Avesta, the earliest memorized record of the Iranian branch of the Aryans, defines the early borders of the Aryan lands to be the Rahā river, now Amū Daryā, in the north, the 'mid-earth', probably Mekrān, in the south; the Hindu river in the east and another Hindu, described as Harayu in another passage and now Harirud in Herat, in the west This corresponds well with Rasa, Sindhu and Sarayu of the Rigveda However, since the first and the last lay in the regions long abandoned by the Vedic Aryans, they were forgotten, to become mythical rivers The Vedics never ventured into Mekrān to mention the fourth corner in their rec ords

The Vendidad, a late Avestan work, is more precise in calling Pakistan by its ancient name of Hapta-Hindu, the Sapta-Sindhu of the Rigveda. Evidently the Vedic Aryans had, by this time, crossed the Indus and had established themselves well in the entire land of the seven rivers And the Iranians knew it Of the sixteen Aryan habitats enumerated by the Avesta, the Indus Valley is the only one located outside the plateau It apparently does not know of the lands lying in the east and the subsequent further expansion in that direction The simmering summer and the early puberty of the native girls of this land were proverbial for the ancient Iranians

The Avesta also mentions, among other mountains, the 'glaciered' Upari-Saena, home of the famous Soma plant Vafraya (lit snowy) is another peak of the extensive range The northern limits of the Indus Valley, as defined by the Vedas, is Himavant (lit snowbound) with its peak called Mujavant (rush-covered), source of the Soma plant It may be noted that the Vedics obtained their Soma supplies from non-Vedic highlanders while the Iranians had it as a native plant.

Although written in about 740 A D , *Bundahishn*, a work in Middle Persian, has faithfully recorded and sometimes correctly elaborated, though with an editing touch, the pre-Achaemenian geographical knowledge of the Iranians It says that the Aparsen (Upari-Saena) range covers the entire Iranian plateau and that one of its arms, Varfomand (Vafraya) extends as far as China It also says that there are only two great rivers in the world - Arang and Veh Both flow from the northern mountain, one to the west (as far as Egypt) and the other to the east Veh, when passing through the land of Sind (Sind bumi), is called Mitran It falls into the Indian Sea (Hindustan raya) The Veh has another name, Kashaf (lit turtle), a name also known in Sind 'Kashaf' in variant readings appears as 'kasha, kashag and kashya' (lit side, bank) It should then apply to the 'Kachchh' and 'Kachchhi' areas of the lower Indus plain We shall elaborate 'Kashaf' (Skt. Kashyapa, Kachchhapa) a little later

Bundahishn distinguishes between the Ṡindhis and the Hindus as people of different races The Indus Valley, in another chapter, is said to be situated closer to the "home of summer, yet it is neither cold nor hot, for during the peak of summer, the rains come and dispel the heat and since it does not rain in winter, the cold is not intense " Only a resident of the Potohar plateau, the old Gandhara with Taxila as its capital, could have made the statement Again, it repeats that the Hapt-Hindu is a part of Eran-shahr, the country of the Aryans It elaborates, rather wrongly, that the Indus Valley is one country but because it has 'seven rulers', it is called Hapt-Hindu It places Inner Kashmir (upper Panjab) in the Indus region

The data provided by what-has-been-left-of the Avesta and its commentary is scanty, because it concerns mostly the religious lore and not the documents of traders and travellers, who were definitely better informed and possessed first hand knowledge

We come now to the Achaemenians—550 to 330 B C—and on solid historical grounds Cyrus the Great extended his empire to the very slopes of the plateau, all inhabited by Iranians, most probably without fighting any big battles During the reign of Darius the Great (522—486 B C), a survey team of "men whose truthfulness he could rely, and among them Scylax of Karyanda" was sent to sail down the Indus river Darius conquered Sind after the voyage was completed and a comprehensive report submitted to him and the Iranians "made use of the sea in those parts" Herodotus does not mention any other member of the team, perhaps because they were not Ionians and he did not know them One thing is of special interest The event was so peaceful that neither Darius nor any other source mentions any of the hardships suffered two centuries later by Alexander, who also followed the same route For the Iranians, it was a smooth sailing on warm waters

Persepolis reliefs are the first to give us a vivid view of ancient Pakistanis of the Indus Valley - the Gandharan in the north, the Sattagydian in the middle and the Sindhi in the south All are shown to belong to a rather hot region They wear loin-cloths, tight tunics, shawls and sandles All carry broad swords The Gandharans carry spears and shields and the Sindhis double-edged axes The reliefs also provide us with fine specimens of the Sindhi bull and ass Also the traditional way of carrying goods in baskets hanging from a yoke across the shoulders Darius also says that the ivory used in his Susa palace came from Sind, Arachosia and Ethiopia The reliefs also mention the Amyrgian Scythians—Saka Hauma—varga,—Hauma gatherers beyond the Oxus Were they the Iranian traders of the plant of the holy drink whom the Vedas mention

Herodotus, drawing deep on Persian sources on the Indus Valley, tells more Gandharans and Sindhis were good archers The Sindh satrapy was the most populous and the richest in the empire He mentions gold, cotton and crocodiles

Later, we find that the Sindhis were among the most trusted bodyguards of the ill-fated Darius III Still later, we note that it was in Pakistan that Alexander met the stiffest resistance and that he left the eastern part of the Achaemenian Empire as soon as he retreated onto the plateau

The Achaemenians maintained up-to-date archives The joint report of the first Indus expedition must have been complemented during the subsequent periods. Moreover, the safe and free movement of the people—satraps, soldiers, merchants and migrants—must have raised the mutual knowledge to an unprecedented level I believe that it was this authentic knowledge that passed onto the train of the 'trained historians and scientists' of Greece who trained the Macedonian conquerer Iranian tradition says that Alexander looted Achaemenian treasures and carried away scientific works to Greece to be translated into Greek and put religious scriptures to flames to be turned into ashes And we have, now, almost all the knowledge of the period ascribed to men of a fighting, fleeting, rushing and retreating army of strangers in a hostile habitation, of whose laws, lores and languages they knew nothing

Now begins the era in which the Macedonians ruled in Iran for about eighty years and the native Mauryans held sway overall that was Gandhara, Sattagydia and Sind and much more The Seleucids could not fight and retake Pakistan They, therefore, thought it wise to maintain good relations with the Mauryans This meant contacts—political, commercial and cultural Who else other than the Iranians could serve as the best medium

After a brief spell of Bactrianized Greek supremacy, we have the Iranian Scythians, Parthians and Kushans in Pakistan and beyond It was but natural for them to have cordial relations with their kinsmen on the Plateau Coins of this five-century period are scattered all over Pakistan, from Peshawar to Daibal—a sign of flourishing commerce

The Kushans were succeeded by the Sassanians Their influence, flooding and ebbing with the time, was along the Indus until the Rais of Sindh came up to push the borders westwards in Mekrān Here again, while we have the coins to speak of the trade, there are no records of the feats of Iranians and Pakistanis fighting each other In spite of occasional battles, the border between Iran and Pakistan was, compared with any other frontier of Iran, the most peaceful of all And this is a great food for thought The Sassanian knowledge of Pakistan must have included political affairs, because one cannot maintain good relations with his immediate neighbours unless one knows them well The relations were so cordial that in spite of the fact that Iran had grown exhausted due to wars with the Byzantine the Pakistanis never took advantage of annexing eastern parts of Iran Even the Arabs were overrunning the plateau, it was the Pakistani Rais to whom the fleeing Yazdgard and later his son turned for help

Trade was flourishing, particularly over the sea and the old ports of Siraf and Daibal were the trade centres long after the two countries had turned Muslim Scientists and musicians from Pakistan were welcomed in Iran and brain loans of top scholars, physicians, musicians and others were given and taken Many books in 'Hinduvi' were translated into Pahlavi Dinkard says that book on "religion, medicine, astronomy, movement, time, space, substance, creation, becoming, passing away, qualitative change, logic and other arts and sciences" were imported, among other countries, from Sind, during the reign of Shāhpūr I (241—72 A D) The Shāhnāmeh says that Bahrām Gur (421—38) came to Sind and won the daughter of the Rai in marriage The Rai reciprocated the visit and took to Iran a large entourage, including seven rajas —reminding the seven rulers mentioned by *Bundahishn* We get glimpses of royal robes, peacock umbrellas and elephant processions The story of 'guess the chess' game is well known Mānī (Manes) is said to have come to the region to get first-hand knowledge of Buddhism

Islam came to Iran in the middle of the seventh century Arabic, the language of the Holy Qur'ān and its script replaced Pahlavī It soon became the international language of the entire Muslim world All wrote in Arabic and all bore Arabic names It is, therefore, a little difficult to differentiate between the 'Arabs and the 'Ajams However, some are easily distinguishable—Balkhī, Bīrūnī, Ibn Khurdādbeh, Ibn Rustā, Ibn Sīnā, Iṣṭakhrī, Jayhānī, Khwārizmī, Ramhurmuzī, Rāzī, Ṭabarī and others with Iranian names and surnames

Iranians held high offices in the Khilāfat administration They played an important part in the Islamic State's social and economic life, particularly in the regions east of the Euphrates Therefore, much of the knowledge in Arabic writings have their origin in Iranian literature

The overall picture drawn by the early Muslim writings is that the country known today as Pakistan was, more or less, called Sind India was known as Hind There is a third term, Hindustan, by writers in Persian, which I believe, was originally applied to the regions inhabited by Hindus and was not the name of a definite country That is why, we see a part of northern Pakistan and the adjoining Afghan territory, as far as Gardīz, called Hindustān The borders were rather fluid, particularly in the east It was the Indus, a little more to the east, the Sutlej or the Rajputana desert The books provide us with the names of major towns and ports as well as the distances separating them The data covers mainland and sea routes, location of towns, rivers, mountains and deserts. Geographical maps give us a vague but useful view of what is what and where

In addition to the geographical data, the books many in Arabic and some in Persian, provide the following information People Sindhis were swarthy, slim and swift The Medes, seamen spread from Multān to Mekrān, were non-Muslims Today, they are found along the Mekrān Coast, are Muslims, and speak

Baluchi Of the Jats, those lived close to the sea, 'ate fish and seafowl' and those who inhabited the hinterland, were shepherds In Mekrān, the common man wore tunics (and baggy trousers) The rich of both Mekrān and Sind dressed like Persians and Irāqīs—turbans and robes The heat made the Multānī to have nothing more than a loin-cloth and a shawl on *Hūdud al-'ālam* mentions the Afghans in the north

Languages The people in Mekrān spoke Persian and 'Mukrānī' and those in Sind and Multān, Arabic and Sindi

Religion Shahristānī, although later than Bīrūnī, draws on earlier knowledge of Hinduism He enumerates what he believes to be different Hindu sects He describes various idols—Shiva, Durga (mistaken to be male) and others resembling them with their skull-necklaces The description of Buddhism is better because it flourished in eastern Iranian lands The ten precepts and other orders are given Nevertheless, it is thought to belong to the Brahman branch of Hinduism Bīrūnī depends on Irānshahrī for his meagre information on Buddhism, who in turn, had derived his knowledge from earlier second-hand sources Iṣṭakhrī describes the Buddha-postured idol of Multan and joins others in the speculation about its make It was a place of pilgrimage for the Hindu world and of economic value for the Muslim rulers The author of *Hudūd al-'ālam* mentions many more towns with temples One Ramayan between Lahore and Multan had a gold-covered copper idol which was circumambulated three times a day by dancing and drumming dames The people of Baluchistan are mentioned as 'gabrakan'—a term used for Zoroastrians Shahrastānī speaks about a dualistic sect of Hinduism However, the religious knowledge is far, rather very far, from being complete—perhaps the Muslims were not interested and the Hindus, in turn, shunned them

Products Musk, jewels and precious cloth were sold in Vayhind (Attock) Dates, limes, mangoes, sugar-candy, skins, leather and saddles were produced in Sind Mekrān was the largest producer of dates and sugar-candy Upper Baluchistan had grapes and other 'cool-region' fruits The country was rich in cattle The people around Kalat had two-humped camels and took out caravans to Fars and Khurāsān Sea trade was very flourishing

Interesting Data Ramhurmuzī tells that the land route between lower Kashmir (the Panjab) and Manṣūrah took seventy days to cover, but people sitting on costus-grass water-proof bail-rafts sailed down the Indus in forty days He has another story A priest in upper Kashmir (the valley) showed his audience a four-thousand-year old earthen jar and advised them to safeguard their spiritual entity, for 'good care can keep a delicate jar like this for ages' Here is the oldest lecture on archaeology and that too for a sermon on the mount Ramhurmuzī also speaks about religious self-immolations

Ibn Khurdādbeh writes that the snowbound mountains of the north were crossed only by a certain tribe of 'infidels', who carried the merchandise on

either side for the merchants of Multān and China—the Sino-Pakistan trade route is old and famous

The crocodiles continued to give the wrong notion that the Nile and the Indus had a common source, though some had amended the Nile to read the Oxus

Here was, then, the gist of my preliminary research on the early Iranian knowledge of Pakistan—a knowledge gained, lost, regained, re-lost, and gained again during the last three thousand years The authors of this knowledge are numerous, some known and many many unknown

Amongst all this, stands Abū Raiḥān Bīrūnī with his own selected and collated collection While the earlier knowledge was mostly second hand, his is first-hand and authentic He is the author of many a book on the Hindu science His *Indica* is the most outstanding one of them He has expounded the religion, philosophy, literature, geography, chronology, astrology, astronomy and many more logies of this land at a very crucial phase of history—at the time when an old culture was fast diminishing and retreating before a new forceful culture

Even his passing remarks make many obscure points clear For instance, he says that the ancient name of Multān was Kashpapura The Greeks of the Achaemenian period mention a Kaspapura or Kaspatura at the confluence of the Indus and its tributaries up near modern Peshawar As already pointed out, *Bundahishn* says that the Indus is also known in Sind as the Kashyapa Putting the three together, we get an old name of the Indus, a befitting name if one counts the countless turtles basking in the Panjnad sun He dispels the notion that the Indus and the Oxus have a common source He informs us that the Qarmaṭian usurper, Jālam ibn Shaybān, was the person who had the famous idol of Multān broken and its priests killed And then he wonders, how could a wooden idol last 216,000 years in a damp place

Although Bīrūnī calls the whole region as Hind, he does differentiate between 'arḍ al-Hind' and 'arḍ al-Sind' and sometimes al-hind and al-sind, and in his *al-Qānūn al-Mas'ūdī*, he has listed most of the present Pakistan under Sind I think that had he written in Persian, he would have used the loose term of Hindustan for the regions not yet Muslim

Since the learned delegates have their papers on various aspects of Bīrūnī's *Indica*, I shall conclude by saying that the entire extant knowledge of the early Iranians as well as that of the Arabs, the Chinese and the Greeks put together stands small and poor when compared with what this genius has preserved Never before so much was collected in so little a time and from so shunning a people, by a single person A thousand years have passed and yet no single person has emerged in the world of Indology to surpass him He stands alone and aloft

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AN INTERPRETATION OF AL-BĪRŪNĪ'S ACCOUNT OF THE HINDU SHĀHIYĀHS OF KĀBUL

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"ABU Raiḥān al-Bīrūnī (d 1048 A D) is one of those greatest scholars that the world has produced both in the field of humanities and sciences His contributions to the exact sciences like mathematics, astronomy, geography, anthropology are as great and important as those in the field of history, social sciences and comparative religion The range of his learning was prodigious particularly for an age when there was no mass publication of books, no scientific journals, no rapid distribution of the knowledge that was available A persistent and omnivorous curiosity, thoroughness, industry, systematic planning and the open mind garnered for his intellectual treasury all that could be learned in his day Al-Bīrūnī combined in himself the universality and timelessness of a great mind. He understood that history was far more than a series of events and that any true history had to be history of ideas and institutions "[1]

In his work *Tā'rīkh al-Hind*, al-Bīrūnī narrates the history and determines the chronology of the Hindu-Shāhiyah Kings of North-Western Panjab and Kābul and the dynasties of Northern India with whom Maḥmūd fell out or formed alliances He provides accurate dates of that Sulṭān's invasions of Hindustan, and records the exact date of Somnath and the legend behind its erection Then he gives a detailed account of the philosophical systems of the Hindus, their religious beliefs and popular customs as he actually observed them in 1,000 A D together with the traditions about the past which prevailed among them

It is not easy to analyse in a short paper al-Bīrūnī's historic account of the various regions of the Indo-Pakistan Sub-Continent and Kābul Covering such a vast canvas needs a dispassionate study of years This being so, the present article covers only an analysis of the following historic terminologies of the

Hindu Shāhiyahs of Kābul recorded in the *Tā'rīkh al-Hind*

"The Hindus had kings in Kābul, Turks who were said to be of Tibet origin The first of them, Barhatakin, came into the country (Kābul). "[2]

" The rule remained among his descendants for generations, the number of which is said to be about sixty "[3]

"One of this series of kings was Kanik, the same who is said to have built the *vihara* (Buddhistic monastery) of Purushavar It is called, after him, Kanikcaitya "[4]

"The last king of this race was Logaturman"[5]. (translated as Katorman by Elliot and Dowson)[6]

Concerning the ethnological background of the Hindu Shāhiyahs of Kābul, Professor A S Altekar, quoting from the Chinese account, records a tribe called Juan-juan, who are said to have been the overlords of the White Huns in Central Asia[7] The study of the Juan-juan, which follows, establishes them as the progenitor tribe of the Hindu-Shahiyahs of Kābul As regards their disappearance from Central Asia, Hilda Ecsady, also basing her information on the Chinese sources, informs us that the Turks, who were the subjects under the Juan-juan Empire, revolted successfully against their liege-lords and destroyed their empire

" as subjects of the Juan-juan Empire, they (the Turks) defeated their co-subjects, the revolting T'ieh-le tribes (547—550), and after the victory, aware of their strength, they asked a Juan-juan princess as bride for their ruler The rude refusal of the Juan-juans, ignoring the change of forces, accelerated the fall of their empire, in 552 (11th of March—9th April) the Turks attacked and defeated the Juan-juans, "[8]

The Juan-juans seem to have disappeared from Central Asia in 555-556,[9] as the Chinese sources are silent on their later history The Juan-juans "migrated to the Panjab during the confusion subsequent to the overthrow of the Kushanas "[10] Panjab here implies West Panjab, North-West Frontier Province and Kābul

The Juan-juans have been identified by Professor A H Dani with the Janjuas[11]

In relation to the royal title of the Hindu-Shāhiyahs, Mas'ūdī informs us that when "he was at Saimur (Chaul) in 304 A H, the ruling prince was Djandja "[12] In another place Mas'ūdī records, "The king of Qandahār, who is one of the kings of Sind and its mountains, is called Hahaj, this name is common to all sovereigns of that country "[13] Sir Denzil Ibbetson, alluding to General Cunningham's

findings, identifies the rulers of Kābul and Hund (described by Mas'ūdī) with the Janjuas " General Cunningham connects Janj the first syllable of their (the Janiva) name, and Chach a tract in Rawalpindi, with the old kings of Hund on the Indus who are said by Mas'ūdī to have borne the name of Chach or Jaj "[14]

General Cunningham is also of the view that the Janjuas were the Hindu Shāhiyahs of Gandahara [15]

By collating al-Bīrūnī's account of the Hindu-Shāhiyahs and the above analysis of this dynasty, it is concluded that the Hindu-Shāhiyahs had Juan-juan as their royal title which later became known as Janjua They originally hailed from Tibet Barhatkin was their first king, who after their discomfiture in Central Asia, established his rule in Kābul and West Panjab Kanik is one of the important Janjua rulers who "founded the Vihar, or Buddhist monastery at Peshāwar, called after his name even in al-Bīrūnī's time, and which probably, occupied the site of the present conspicuous building, called the Gor-khattri, at the eastern entrance of that town "[16]

It is often understood that it was Kanishka who built the Buddhist monastery at Peshāwar But the accession of Kanishka "has been dated anywhere between A D 78—144, " [17] and as already mentioned the Juan-juans migrated to the valley of Kābul and the West Panjab after the overthrow of the Kushanas This being so, Kanik and Kanishka cannot be the same, and as the monastery was known after Kanik's name in al-Bīrūnī's time, it cannot be Kanishka who built the monastery at Peshāwar The exstence of the Hindu Shāhiyah rule in Chitral is confirmed by a Sanskrit inscription of 90° A D which stands at a village called Barenis, 27 miles away from the town of Chitral

Al-Bīrūnī's reference to Katorman as the name of the last king of the Hindu-Shāhiyahs is of historic significance So to speak, the last of the Janjua rulers of Kābul and West Panjab was known by the name of Katorman The Katorman or Kator was the name of one of the tribes of Kafristan [18] The ruling elite of Chitral bore the title of Kator in the ancient and the medieval times The present royal family also adopted the same title when in the middle of the sixteenth century they came to power in Chitral [19]

Analysing the title Kator, it appears that a descendant of Katorman, the Hindu-Shāhiyah ruler of Kābul and West Panjab, happened to be the governor of Chitral who preferred to be known as Kator after the name of his king This being so, the Hindu-Shāhiyah dynasty became extinct at Kābul, its progeny continued ruling in Chitral with the title of Kator The Kators, therefore, constitute a branch of the Janjua lineage of Kābul and the West Panjab

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[6] Ellıot and Dowson's *Hıstory of Indıa as Told by ıts Own Historians* (Alıgarh reprınt, 1952), p 401 For further reference see pages 403, 404 Katorman recorded ın the 'Jamı'al Tawarıkh' and also the same narrated by Bınakıtı

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LAHORE AND AL-BĪRŪNĪ

MUHAMMAD WALIULLAH KHAN

ABŪ Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī in his history of India, Ta'rīkh al-Hind, compiled in about 1030—33 A D from his personal knowledge of the country at the time of Maḥmūd's invasion mentions Lahore, the capital of the Punjab, as a region

He writes, "Thence marching towards the north-west, you come to Adittanhaur, 9 farsakh, Jajjanir, 6 farsakh, Mandahukur the capital of *Lauhawur*, east of the river Irawa, 3 farsakh" [1] Farsakh is variously measured and sometime it was even used for a stage in a journey, but generally speaking it is equal to $3\frac{1}{8}$ English miles Mr J H Thornton author of 'LAHORE' identifies Mandahukur or Mandhukot with Mankot,[2] a place near Sialkot and believes it to be the capital of the last native dynasty However, no such place as Mankot is now traceable near Sialkot

Kūr or koor is a Pushtu word meaning house and Mandahukur may be a corruption of Maḥmūd Kur or Mahmūd Koot as pronounced by the Pushtu speaking army of Maḥmūd

Mand in Sanskrit is the name of planet Mercury ('Atārid, Rohini) and there is a Rajput tribe named Mandahar which now is mostly found in Karnal, Ambala and Patiala districts They along with Kandahar, Bargujar, Sankarawal and Panihar are said to be descendants of Lava, the son of Rama Chandra and the traditional founder of Lahore Therefore, it is just possible that there was a colony or fort of Mandahars somewhere in or near Lahore There is a village Mandianwala perched on a mound only 12 miles from Lahore on Lahore-Lyallpur Road Maḥmūdpūr of Maḥmūd's coin, I think was no other than the present Lahore Fort from where Maḥmūd's coin of Ghaznah mint dated H 416 (1025 A D) was discovered in the excavations conducted in 1959 Fortunately al-Bīrūnī gives the latitude of Mandahukur or Mandakakur as 31° 50′ It may be added here that latitudes observed by al-Bīrūnī are the same as that of Lahore

For example compare the latitudes of the following towns as given by al-Bīrūnī with their modern and up to date ones

	Al-Biruni's	*Modern*	*Difference*
Multan	29° — 40′	30° — 12′	—32′
Sialkot	32° — 58′	32° — 31′	+27′
Jhelum	33° — 20′	32° — 35′	+45′

The modern latitude of Lahore is 31° — 34′, thus there is a difference of (31° — 50′ — 31° — 34′) only 16 minutes with that of Mandahukur This means that Mandahukur was not far from modern Lahore

Thus Lauhawur is the first authentic reference to Lahore, the capital of the Punjab

Mandahukur may have been the capital of Lauhawur, but it does not mean that *Lauhawur* was not existing when al-Bīrūnī visited the country Many principalities are named after one of their capital town, such as Patiala State was known after the city of Patiala, Hyderabad State after the town of Hyderabad and above all we know for certain that Lahore was conquered and annexed to Ghaznavid Empire in 1021 A D Cities do not spring up overnight and Lahore, therefore, must have been in existence at least in the 10th Century A D

Al-Bīrūnī has also mentioned some more towns answering in name to Lahore They are (i) Lohavar[3] (ii) Lauhawar[4] (iii) fortress of Lahur or Lauhur[5] and (iv) *Lauhawur*[6] These different names are the source of great confusion and controversy in the way of identification of Lahore, the capital of the Punjab and as such it is necessary to examine these references —

(i) *Lohavar*

In his *Ta'rīkh al-Hind* (al-Bīrūnī's India edited by Eduard Sachau, Vol II, London, 1910) on page 8, he says —

"The people living in the country Nirahāra (The present Ningrahār, the valley south of Jalālābād and north of Ṣufed Koh) behind Marigala, as far as the utmost frontiers, of Kakeshar and Lohavar, begin the year with the month of Margasirsha and reckon our gauge-year as the 108th year of their era The people of Lambaga, Lamghān (i e the present Laghman, the country north of Kābul river and between Kābul and Jalālābād), follow their example"

Here a country Nirahāra has been located behind Marigala and there is also a mention of the frontiers of Takeshar and Lohavar Fortunately Marigala,

a hill as well as pass, about 3 miles south-west of Taxila, still retains its name and thus helps us to identify Takeshar with Taxila The location of Nirahāra has been mentioned as behind Marigala, though it is about 150 miles west of Marigala and then Lamghān is placed just north of Nirahāra and north-west of present Jalālābād Apparently the author is giving a description of a country west of Marigala and therefore, there could be no place in that region for Lahore, the capital of the Punjab The only possibility is that it is Lohor (Pathans pronounce Laor) in the N W F P near Hund, which fulfils the conditions of the topography

(ii) *Lauhawar and fortress Lahur or Lauhur*

On pages 207-208 of al-Bīrūnī's India Volume I, London 1910, al-Bīrūnī giving account of the river Sindh, its upper course and the north and north-west frontiers of India states —

"*The river Sindh rises in the mountains of Unang in the territory of Turks* Their king has the title Bhatta Shah Their towns are Gilgit, Aswira and Shiltas, and their language is the Turkish Marching on the left side of the river, you always pass through cultivated ground and reach the capital, marching on the right side, you pass through villages, one close to the other, south of the capital, and thence you reach the mountain Kularjak which is like a cupola, similar to mountain Dunbawand The snow there never melts It is always visible from the region of Takeshar and Lauhawar The distance between this peak and the plateau of Kashmir is two farsakh The fortress Rajagiri lies south of it and the fortress of Lahur west of it, the two strongest places I have ever seen The town Rajawari is three farsakh distant from the peak This is the farthest place to which our merchants trade This is the frontier of India from the north "[7]

The above apparently is the account of the hilly course of the Indus and at the very outset we can say Lahore, the capital of the former Punjab could not have been located there, but let us further examine the matter Al-Bīrūnī names a certain mountain which he calls Kularjak and tells that it looks like a cupola, like mountain Dunbawand, and that snow never melts there He further specifies it by telling that it is always visible from the region of Takeshar and Lauhawar No mountain is visible from Lahore, the capital of the Punjab or from its environs even on a very clear day and therefore the Lauhawar of al-Bīrūnī cannot be identified with Lahore, the capital of the Punjab As already mentioned above it clearly appears that it is the Lahor of the N W F P near Hund from where the mountains of upper region of the Indus are visible He further says that to the south of mount Kularjak lies the fortress of Rajagiri which can be no other than Giri Fort about 5 miles north, north-east of Taxila It was the fort where Mas'ūd I, was imprisoned by his brother Muḥammad in 1037 A D[8] The remains of this big fort can still be seen.

Still further, he says that the fortress of Lahur lies west of it (Mount Kularjak) This finally clears the matter as Lahore, the capital of the Punjab, lies east of the Indus region and, therefore, the fortress of Lahur can, on no grounds, be identified with Lahore Fort of Lahore, the capital of the Punjab

Again it is Lahor (Laor) near Hund in the district Mardān of N W F P which is on the west of the Indus region and where there are high mounds and extensive remains The high mound now occupied by the Police Station may be the site of the fortress which al-Bīrūnī mentions as one of the two strongest places he had ever seen The objection here can of course be that, if Lohavar and fortress of Lahur or Lauhur were identical places why the learned author spelt it in two different ways in one and the same sentence, but this is not very strange, since al-Bīrūnī has variously spelt the same place in his Ta'rīkh al-Hind (Edited by E C Sachau under title of "Al-Bīrūnī's India" in *1910)* as will be clear from the following quotations —

1 "Region of Takeshar and Lauhawar" Vol I, p 208

2 "As far as the frontiers of Takeshar and Lohavar", Vol II, p 208

3 "Fortress of Lahur west of it" (Mount Kularjak), Vol I, p 208

4 "Fortress of Lauhur, Vol I, p 317

5 "*Lauhawur* east of the river Irawa (Ravi), Vol I, p 206

Here apparently Lauhawar and Lohavar under 1 and 2 above are one and the same region or place, and fortress of Lahur and fortress of Lauhur under Nos 3 and 4 above are spellings of one and the same fortress

Lauhawur, however has been well defined as east of Irawa and mentioned as a region of which the capital was Mandahukur Here we are certain that the region of Lauhawur was east of the river Irawa (Ravi of today, Irawati or Irawadi of post Vedic period and Parusni of the Rigvedic period) and as such without any doubt we can say that *Lauhawur* can be identified with Lahore the capital of the Punjab and Lohawar with the town of Lahur or Lauhur (present Laor) of N W F P where in al-Bīrūnī's time was a great fortress Further in connection with latitudes which al-Bīrūnī observed he says —

"I myself have found the latitude of the fortress of Lauhur to be 34° - 10′ The distance from Lauhur to the capital of Kashmir is 56 miles, half the way being rugged country, the other half plain "[9] Now this fortress of Lauhur can be no other than the disappeared fortress at Lahor (Laor) in N W F P near Hund the latitude of which according to the modern observations to 34°—31′ and that this cannot be the Fort at Lahore the capital of the Punjab of which

the latitude is 31°—34′ and we also know, as already discussed above, that the latitudes observed by al-Bīrūnī are fairly correct having a difference of minutes and not degrees when compared with the scientifically observed latitudes of this age

Our earlier conclusion is here further confirmed that Lohawar, fortress of Lahur or Lauhur cannot be identified with Lahore the capital of the Punjab, for which al-Bīrūnī has used the name of *Lauhawur* as against Lohawar Here al-Bīrūnī gives a distance of 56 miles between Lauhur and the capital (Srinagar) Though distance was merely a guess in those days, yet even this goes in favour of Lahor in N W F P Taking the distance as a crow flies, Srinagar is 180 miles from Lahore, the capital of the Punjab and 140 miles from Lahor (Laor) near Hund of N W F P, and in both the cases half the journey tract is plain and the other half, hilly and rugged

It may also be added here that Lahur (Laor) of the N W F P has been mentioned by Hsuan Tsang as (So-lo-to-lo) Salatura during the period from 629—645 A D This means that the *town* was named as Lahor after the middle of 7th century A D It was the birth place of Pānīnī the celebrated Sanskrit grammarian of the 4th century B C It is just possible that it was so named by Kallar, the ancestor of Hindu Shāhiyah Kings of Kābul, who deposed the last king of the Turki Shāhiyahs, some time towards the end of 9th century The Turki Shāhiyahs claimed their descent from Kanishka and, therefore, Turks had made their first capital at Kābul, but in 870 A D after their defeat by the 'Arab, Ya'qūb bin Lais, they transferred it to Ohind (Hund) and it was there that a few years later they were replaced by Hindu Shāhiyahs who continued to be called as Shāhiyahs of Kābul, though it was never actually in their possession It may also be mentioned that these Hindu Shāhiyah kings of Kābul were Bhatti Rajputs of solar race, the descendants of Lava, the son of Rama Chandra, and not Brahmans as generally supposed In the year 1008 A D in his fifth expedition, Maḥmūd utterly defeated Anandpal in a battle fought at a place between Hund and Peshawar and after this battle the Hindu Shāhiyahs were uprooted from the country west of Indus and it was after this event that they changed their capital to Lahore, the capital of the Punjab This means that Lahore was existing before 1008 A D though it might be an un-important town under the same or some other name, and might have been renamed Lahore after the Lahor of the N W F P the lost city of the kingdom, by Anandpal when he made it the new capital of his kingdom

The various accounts regarding the origin of Lahore and its identification cited above may be enumerated thus

1 Traditionally the foundation of Lahore is attributed to mythic Lau or Lava, son of Ram Chandra, the hero of Ramayana, but it appears that like other towns answering in name to Lahore, situated at different places in the

country, the capital city Lahore, of the Punjab, was also founded by some Rajput prince of solar race, a descendant of Lava When and by whom, is not possible to ascertain, since the early history of Lahore is quite obscure and no events relating to it are known before 1021 A D When it was finally conquered by Maḥmūd from the Hindu Shāhiyah king, Trilochanpal and permanently annexed to Ghaznavid Empire, its regular history starts However, it does appear that as an unimportant town not known to history, it was existing prior to 1008 A D, under the same or some other name and that Anandpal after his defeat in 1008 A D when he was uprooted by Maḥmūd from the country, west of the Indus, made it the new capital of his kingdom It is not unlikely that Anandpal renamed his new capital as Lahore after the town Lahor near Hund in the former N W F P was lost to Maḥmūd in 1008 A D

2 That al-Ahwar of *al-Bālāzurī*, Lahor of *Ḥudūd al-'Alam* Lohavar, Lauhawar, Lahur and Lauhur of al-Bīrūnī are identifiable with the town Lahor near Hund in the former N W F P and not with Lahore, the capital of the Punjab[10]

Similarly it is highly doubtful that Lavpor of Deshwa Bhaga and Loh-kote of Prince Keneksen, the forefather of Ranas of Mewar, refer to ancient Lahore, preferably they refer either to Lauhur in the N W F P or Loh-kot of Kashmir

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[4] Al-Bīrūnī's India, Vol I, page 317

[5] Sachau, Eduard C, Al-Bīrūnī's India (Ta'rīkh-ul-Hind), London, 1910, Vol I, page 208, 317 respectively

[6] Ibid, Vol I, page 8

[7] Sachau, Eduard C, Al-Bīrūnī's India (Ta'rīkh-ul-Hind), London, 1910, Vol I, pp 207-208

[8] Marshall, Sir John, Taxila, Cambridge, 1951, Vol I, pp 77—79

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AL-BĪRŪNĪ'S RESEARCH METHODOLOGY*

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THE author cites the principles of modern philosophy to assert that preconceived hypothesis is always misleading which can twist facts to meet its requirements The scientific method on the other hand advocates direct study of facts accurately and objectively In this way much of what is untrustworthy is eliminated In this light al-Biruni's *Kitab al-Hind* displays a true scientific study, to provide a reliable and authentic guidance, "for those who wanted to take up polemics with the Hindus or wished to mix up with them" (in al-Biruni's own words) In the effort, mere hearsay was discarded, and so also second hand information, and only concrete and personally observed practices in all fields of Hindu society were recorded Whenever the records are insufficient he does not hazard a guess but informs the reader frankly of his limitations Even when he singles out their narrow mindedness and unreasonable pride, he is objectively assessing their attitude of selfishness and self-centredness, and not out of any dogmatic unfairness to Hindus By virtue of his knowledge of many other languages, literature and people, his objectivity acquires a comparative study and honest historiography Although he knows diverse aspects of knowledge in various fields of learning of the Hindus but he still refuses to confuse knowledge with superstition This enables him to point out where they are mixed up in the Hindu philosophy

Al-Biruni's greatness therefore is in his superior ability of scholarship to collect and coordinate an almost incomprehensible hotchpotch of beliefs, superstitions, customs, prejudices and intellectual contradictions and give the world an authentic account of a society

*This is an abstract of the paper presented

NOTES ON BĪRŪNĪ'S FIHRIST

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ABŪ Raiḥān al-Bīrūnī is known to the world mostly as an astronomer and a mathematician, while he was also a philosopher, an historian, a geographer, a pharmacologist, an ethnologist and an anthropologist In this paper we shall attempt to focus on one of his books which will display his significance as an historian of science and a competent bibliographer The *Fihrist* of Bīrūnī a unique copy of which exists in Leyden (MSS No 133) was first published by Paul Kraus in Paris in 1936 Even before its publication, it had attracted the attention of a number of scholars In 1920 E Wiedmann published its section on the works of Bīrūnī in German, and in 1925 J Ruska published the section on the works of Rāzī in the same language E Sachau also has used the *Fihrist* in his introduction to *Āthār al-Bāqiyah* Scholars who have prepared bibliographies of the works of Bīrūnī have had this book as their main source of information We mention here a few such as D J Boilot who wrote in French Sayyed Khān who wrote in English and A Habībī who wrote in Persian and Pashto

It must be noted that Bīrūnī, in compiling this bibliography, followed his predecessors such as Galen of Pergamon who compiled a list of his own works called Pinax (in Arabic binax and finax) and Hunayn Ibn Isḥāq who compiled a bibliography of the works of Galen

In the beginning of the *Fihrist* Bīrūnī mentions that it was written at the request of a person who was eager to know about the works of Rāzī, as well as the beginnings of the science of medicine Concerning the latter, Bīrūnī refers to the *History of Physicians* by Hunayn Ibn Isḥāq which is fortunately available in Arabic and in an English translation by F Rosenthal (Oriens, 1954) Concerning the request about the works of Rāzī, Bīrūnī indicates that out of respect for that person, he undertook the compilation of a bio-bibliography of Rāzī This means that, but for the respect for the man, Bīrūnī would not have undertaken the project His reluctance was due to the fact that the opponents of Rāzī might think that he was in favour of Rāzī's views Bīrūnī then refers shortly to Rāzī's work on prophecy (*Kitāb al-Nabuwwat*), the same book that he classified together with *Makhāriq al-Anbiā'* among the heretical works of Rāzī As we know, the

work of Rāzī on prophecy was refuted by his fellow country-man Abū Hātim Rāzī (an Ismā'īlī dā'ī) in his work called *'Ālam al-Nabuwwah* A mu'tazilī theologian called Abū 'Alī Ibn al-Khallād has also refuted this work The work of Ibn al-Khallād is now lost, but the commentary by Abū Isḥāq Naṣībī al-Mu'tazilī exists in the British Museum (OR MSS 8613) In some other Islamic works there are references to the heretical writings of Rāzī Some of these works are Maqdasī's *al-Bad' wal Ta'rīkh* and Niẓām al-Mulk's *Siyār wal Mulūk* But Ibn Abī Uṣaybo'ah is of the opinion that the opponents of Rāzī forged these books and attributed them to him Bīrūnī adds that he has read *Kitāb āl-'Ilm al-Ilāhī* and is of the opinion that Rāzī was influenced by *Sifr al-Asrār* of Mānī It is for this reason that for forty years Bīrūnī eagerly wanted to see this book (*Sifr al-Asrār*) It should be noted that *'Ilm al-Ilāhī* was one of the important works of Rāzī, and not only Muslims but also others have attached importance to this book Among non-Muslim scholars we can mention Illiyāi Naṣībiyānī who used *'Ilm al-Ilāhī* in his treatment of the problem of substantiality of God, and Maimonides who used the same work in his treatment of the problem of pleasures and evils A number of Muslim scholars used *'Ilm al-Ilāhī*, Majritī quoted from this book in connection with the worship of the Sabaeans, Sa'īd al-Andalūsī in connection with doctrine of dualists, Ibn Hazm on the problem of transmigration and the five eternals, and Nāṣir Khusraw on the problem of matter and space This book has also been refuted by Fārābī, Ibn al-Haitham, Ibn Rizwān, Nāsir Khursraw, and Ibn al-Hazm Therefore, it is evident that Bīrūnī had recognized the importance of this work

Bīrūnī gives the dates of the birth and death of Rāzī and shows how the latter shifted from alchemy to medicine and how he achieved fame in medicine Bīrūnī then enumerates one hundred and eighty-four books by Rāzī and classifies them as follows 56 on medicine, 33 on the natural sciences, 7 on logic, 10 on mathematics and astronomy, 7 summaries of other scholars, 17 on philosophy, 6 on metaphysics, 14 on theology, 22 on alchemy, 2 on heresy and 10 on various other subjects Bīrūnī's *Fihrist* after that of Ibn al-Nadīm is the most important source for the works of Rāzī Although the author gives only the titles of these works, the list gives us a great deal of information concerning sciences and their history For example, we find that two Mu'tazalite scholars, Jāḥiz and Nāshī who wrote independent refutations on medicine, were refuted by Rāzī Further we find that discussions on the problem of time was held between Rāzī and Abū al-Qāsim Qābī, the Mu'tazalite leader in Baghdad This same Qābī refuted Rāzī's book on *'Ilm al-Ilāhi* Again we find that Masma'ī, who was the pupil of Naẓẓām, wrote a refutation against those who believed in the eternity of the matter, and Rāzī who himself believed in the eternity of the matter, refuted Masma'ī's work We note further that discussions were held between Rāzī and Shāhid Balkhī on the problem of pleasure and pain, and that Rāzī refuted him on the problem of *Ma'ad* Finally he refuted Aḥmed ibn Kayyāl on the problem of *imāmat*

Concerning the beginning of the science of medicine, Bīrūnī says that some people believe that sciences owe their origin to revelation (waḥī) and that each science has a prophet There are other people who, according to Bīrūnī hold that sciences are an instinct which is in man in potentia and in other animals inactive In this connection he refers to the method of enema, *hognah*, which was learned from a bird that used to fill its beak with sea-water and insert it into itself through the anus He also refers to burying of the dead which, according to the Qur'ān, was learned from crows

Bīrūnī has made a chart of the names of physicians that begins with Osklibus the first, and ends with Galen Then in dating the periods in which they lived, he has written detailed accounts using Iranian, Alexandrian, and Jewish histories until he reaches the time of Galen Here he mentions two books by Galen both of which are available today The first is his book on anatomy, *Tashrīh*, which was published by Max Simon with a German translation in Leipzig in 1906 The second on moral character, *Akhlāq al-anfās* was published in an abridged version by Paul Kraus in Cairo in 1937 Bīrūnī says that the majority of scholars regard the Greeks as the inventors of medicine, while some others believe that it was the result of revelation, and still others consider it to be the result of experience In this section Bīrūnī gives us a great deal of information about the old centres of medical science and the methods by which Persian kings and Indian Brahmins preserved the scientific heritage among special classes He also discusses the question of the eternity or createdness of sciences and mentions the book of Charak which is one of the most ancient Indian works on medicine

Bīrūnī then says to the above mentioned person, that now that he had fulfilled his wish about the works of Rāzī and the beginnings of medicine, he would conclude by giving a list of his books which he had also once wanted to know That is, the books which he had written up to the 427, the year in which he was 65 lunar and 63 solar years old

Bīrūnī enumerates 113 books of his own, some of which were at that time incomplete Then he mentions a dream that he had when he was 61 years old, and the predictions about his life by the dream-interpreters Ghaḍanfar Ṭabrīzī, in the supplement to the *Fihrist* of Bīrūnī, has explained in detail the astrological explanation of this dream Fortunately Bīrūnī was able to complete his works The *Qānūn Mas'ūdī* and *Āthār al-Bāqiyah* which are now extant are among those books

At the end of the Risālah he mentions the books which Abū Naṣr Manṣūr ibn 'Irāq, Abū Sahl Masīḥī, and Abū 'Ali Jilī had written in his name, and says that his own books were like his children, while the books that were written in his name were like his adopted children He further notes that he did not make any difference between his own books and those written in his name As has been mentioned earlier, Bīrūnī's books numbered one hundred and thirteen, and if we

add the books written in his name, the number comes to 138 While listing his own books, Bīrūnī mentions the names of many scholars, e g al-Khwārizmī, Abū al-Ḥasan Ahwāzī, Faraghānī, Abū Sahl Kūhī, 'Umar Ibn Farrukhān, al-Baṭṭānī and Abū Ma'shar Balkhī

Unfortunately all the works mentioned by Bīrūnī in the *Risālah* have not been preserved for us But what is available is enough to show his mastery and skills in different sciences It is hoped that some more of his works will be discovered and be made available to scholars

About two centuries after Bīrūnī, a man from Ṭabrīz called Abū Ishāq Ibrāhīm and known as Ghaḍanfar, who had great interest in astronomy, wrote a treatise called *al-Mashāṭah li Risālah al-Fihrist* in which he expressed his knowledge about the works of Bīrūnī and wrote a detailed account of the greatness and value of the works of the master Ṭabrīzī has specifically mentioned some of the works of Bīrūnī, including *al-Tafhīm* and *Patanjali* A unique copy of *al-Mashāṭah* has been preserved in the same collection in which the *Risālah* is included Our knowledge about Ṭabrīzī is very limited What is known to us is that he made a copy of Bīrūnī's *Kitāb al-Saydanah*, and that he became aware of the works of Bīrūnī and the depth of *Patanjali* through Abū 'Abd Allah Muḥammad ibn abū Bakr Ṭabrīzī Ṭabrīzī is the same person who wrote a commentary on the 25 premises of Ibn Maimūn Professor Wolfson of Harvard University in his famous work *Crescas's Critique of Aristotle* (Harvard 1929) has mentioned this as one of the most important commentaries on *Dalālāt al Hairin*, but has no information about the author who was one of the great scholars on Bīrūnī in the 7th century A H

To conclude, the *Fihrist* of Bīrūnī is a very important source of information about the biography and bibliography of both Bīrūnī and Rāzī A study of this work also gives us knowledge of the development of different sciences, specially medicine, up to Bīrūnī's time There are errors in the only manuscript which is available to us A careful study of the work may enable us to correct those errors

AL-BĪRŪNĪ AS A HISTORIAN OF CULTURE*

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THE author regards al-Bīrūnī as the prime historian who retrieved history from the monotonous alleys of courts and warfare and brought it in open societal environs touching every aspect of life This raised the dimensional perspective of history and inducted philosophy to play its vital role in it It would not be wrong to emphasise that both al-Bīrūnī and Ibn Khaldun were impelled by the Qur'ān's philosophy of history to probe into the conceptual and practical aspects of life of nations and make them a topic of their historical discussion This Qur'ānic philosophy guides the historian to study the religious practices of nations to gain a hold on their driving concepts and forces, then apply the scholarship attained to form wise and thoughtful explanations of their social functions, and fathom the causes of their rise and decline Historical recounting then becomes a displaying of all the facts of a nation's wholesome portrayal to educate the coming generations with a moral to take note of Al-Bīrūnī's famous books on history, specially *Kitāb al-Hind* and *Āthār al-Bāqiyah* perform all the nuances of excellence which takes the reader to the fourth century Hijrah stations of history to observe the immense comprehensiveness of his portrayal

Culture is in essence a procreative contributor to historical substance and al-Bīrūnī took extreme sufferings to attain a vantage position for scientific analysis of the Hindu culture and civilization and keep this study clean of any bias or lopsidedness, to a stage of perfection which we fail to find even in Hegel and Toynbee We can only say then that al-Bīrūnī was born one thousand years before his time, and al-Bīrūnī would today have been a very great asset to the world of scholarship

*This is an abstract of the paper presented

SCIENCE, HISTORY AND RELIGION : SOME REFLECTIONS ON THE INDIA OF ABŪ RAIḤĀN AL-BĪRŪNĪ

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FOR all his individual genius, Bīrūnī lived in an age when the intellectual life of Islam was preparing its descent into encyclopedism By the eleventh century medical encyclopedias were already commonplace, and Bīrūnī's contemporary Ibn Sīnā had fulfilled the promise, or the threat, implicit in the "divisions of the sciences" tracts in common use in the university classrooms of late antiquity and had produced the first encyclopedia of philosophy and the sciences in his *Book of Healing* History too, with Ya'qūbī and Mas'ūdī, had thrown open its doors to allow entrance to world history, a notion that embraced everything from the creation to the death of the latest Caliph

To compose an encyclopedia demands either a genuine *polymathia*, a universal understanding, or the ability to assimilate and organize other people's learning on a wide variety of subjects Islam was schooled in both those arts almost from the beginning in that its legacy from Hellenism came to it in the form of university learning which was already organized in curricula and distributed across a great variety of textbooks The very first medical literature translated into Arabic, for example, were Galenic textbooks and medical encyclopedias currently in use in the medical faculties at Alexandria and Jundishapur The *kunnash*, the medical encyclopedia, came into Islam well before the *masā'il*, the research literature

Ibn Sīnā's *Book of Healing* illustrates another aspect of Islam's Hellenically-inspired *polymathia* A Muslim learned in the "foreign sciences" came to those disciplines as they were understood in the philosophy faculty at Alexandria Medicine apart, one did not train to be a scientist in late antiquity, one studied philosophy, a discipline that was understood to include logic at one end, metaphysics at the other and between them most of what we call the "natural

sciences" Ibn Sīnā's *Healing* is formally nothing more than that ideal curriculum of the philosophy faculty fleshed out from outline to encyclopedia by the insertion of resumes of the textbooks in their appropriate places What might have taken eight or ten years to get through by the lecture method at Alexandria in the sixth century was here in the eleventh put between the covers of a single book

This kind of curricular *polymathia*, a kind shared by Bīrūnī, was particularly Greek, and its presence in Islam was an inherited good But Islam rejoiced in another type of *polymathia* that was unmistakably its own and that was ecumenical rather than encyclopedic One has only to open the pages of Ibn al-Nadīm's *Catalogue* and lay them beside the *Library* of the Byzantine Patriarch, Photius, to appreciate the enormous breadth of learning in Islam and how little it owed its range to Hellenism The *Library* of Photius is a record and a digest of the Patriarch's reading in the first half of the ninth century It is an impressive collection, the reading of a man of considerable schooling and of catholic tastes But it is all Greek, the classics of pagan and Christian Hellenism Through Ibn al-Nadīm's tenth century bookstore had passed, on the other hand, not only the books of Islam's home-grown "traditioned sciences" but the learning of the Greeks, Romans and Iranians, the Franks and the Chinese, Jews, Christians, Zoroastrians, Manichaeans and the sects of India

Though more specialized than Ibn Sīnā and nowhere so wide-ranging as the author of the *Catalogue*, Bīrūnī belonged to both traditions of *polymathia*, the curricular and the ecumenical He had doubtless studied both the traditional Qur'ānic sciences and the staples of the Hellenic philosophical curriculum, but Bīrūnī's specialization lay within the mathematical quadrivium of the "foreign sciences" These latter disciplines, it is well known, were Greek in their theory, their methods and their general outlook, and how well Bīrūnī mastered the Greek textbook style in his own chosen field is revealed by a simple examination of the first half of his *Introduction to the Elements of Astrology* which is a model of Hellenic mathematical pedagogy by a man who neither learned nor taught in any educational institution remotely resembling the pre-Islamic university at Alexandria

The passage of cultural goods across linguistic and religious frontiers was, then, nothing extraordinary in Islam, and wonder at Bīrūnī's interest in India should be tempered somewhat by the realization that his own formation was the result of just such another borrowing The wonder-workers of that earlier cultural encounter were the pioneer scholars of the late eighth and ninth centuries who also had to master difficult scientific texts with little or no background and in a language other than their own Bīrūnī had the luxury, as they did not, of thinking Greek mathematics in his own native idiom Indeed, thanks to generations of earlier scholars, Greek mathematics *was* Bīrūnī's native idiom

Through Ibn al-Nadīm and others we have a fairly detailed picture of Islam's earlier discovery and expropriation of the scientific treasures of Greece Hārūn al-Rashīd and particularly his son Ma'mūn had sent teams of scholars across the political frontier with Byzantium to search out Greek manuscripts Once returned to Baghdad these same scholars turned to collating their finds and rendering them into Arabic This early generation of translators was followed in turn by schools of editors and exegetes who glossed the new texts By the time that Greek philosophy passed to Ibn Sīnā and Greek mathematics to Bīrūnī they had been worked over by many learned hands Such were the texts and other resources available in Arabic in the eleventh century that it was no longer necessary to know Greek to appreciate the subtleties of Greek science

On the testimony of the *India*, Bīrūnī was proposing to perform a somewhat similar task with respect to Islam's eastern neighbour What leap to view are not, however, the similarities of the efforts but their differences The earlier discovery of Greece was a true discovery for the Muslim, a landfall of a new cultural continent There had been scouts, to be sure, in the person of the Syrian Christians who knew and savored Hellenism, but Islam knew nothing of such things Bīrūnī, on the other hand, was returning to a familiar terrain though he is not always generous in his estimate of his predecessors, they did exist His *Chronology of Ancient Nations* long antedated his study of Sanskrit and his own personal research on India, it contains, nonetheless, signs of the familiarity with Indian science that any Muslim mathematician might be expected to possess

There is no mystery as to whence such familiarity derived Three and a half centuries before Maḥmūd's arms carried Bīrūnī to India there were Muslim scholars in Baghdad who knew both Indian science and the basic tenets of Hinduism And yet the tradition so auspiciously begun was not a continuous one, as it was in the case of Greek learning What started with Mansūr likely ended with Hārūn, Ibn al-Nadīm, at any rate, writing two centuries after that first dawn of interest in India, had only the vaguest idea about the earlier translation activity from Sanskrit into Arabic Thus Bīrūnī had predecessors in his interest in the body of science in Sanskrit but no on-going and continuous tradition to which he could connect himself

Nor did he succeed in creating such Though he clearly addressed himself to the original Sanskrit texts, Bīrūnī's efforts did not issue in the production of Arabic versions of those texts but rather in considerably truncated resumes of their contents As he himself says (I, 8), *he had once translated some Sanskrit tracts into Arabic—curiously they were religious and philosophical rather than scientific texts—but he hoped that this present work, the *India*, would enable the reader to dispense with those translations

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*Unless otherwise specified, this and all subsequent citations are from Eduard C Sachau's ***Alberuni's India***, London, 1910

It is instructive to compare Bīrūnī with Hunayn ibn Isḥāq in this regard Hunayn was a translator as well as a scientist He produced finished Arabic versions of Galen among others and thus, at a stroke, Galen became in effect a naturalized Arab author The Arabic language was enlarged by the creation of a new technical vocabulary to accommodate the recently arrived "Jālīnūs" Bīrūnī's translations, on the other hand, were for his own personal enlightenment and use They never became public property in the way Hunayn's had, and the authors thus translated never ceased being alien presences that could now indeed be inspected, but only through the eyes and intelligence of Bīrūnī Hunayn, once he had translated, stood aside, Bīrūnī's authorities remain embalmed in the *India*

There is something of a paradox here Bīrūnī is admired precisely because he was not a translator, that he was not engaged in the business of assimilating things Indian into the intellectual tradition of Islam but in trying to understand them in their original context, that he was functioning in short, as a historian But here too Bīrūnī's treatment of India differs markedly from what had been done to the Greeks by his predecessors "Jālīnūs" had indeed become a naturalized Arab author, but there was little or no understanding of Galen as a physician of the Roman Empire or of Plato as a philosopher in fourth century Athens Islam produced many successful translations of Greek authors but no real history of Greek civilization

Although historians like Mas'ūdī did have some vague and unrealized sense of the general political structure of the Greco-Roman *oikoumene*, and perhaps even a greater sense of it than Bīrūnī had of Indian political history, what they lacked and what Bīrūnī possessed was a knowledge of the rich religious and cultural background against which both the deeds of the rulers and the work of the scientists and philosophers could be read For all their immense learning in Aristotle, for example, the Muslim philosophers stood disarmed before the mysteries of his *Poetics*, the one work of his that demanded some understanding of the Hellenic *paideia* Their ignorance of Homer and Sophocles simply defeated them, Bīrūnī suffered no such defeats

If it is the glory of Bīrūnī that he approached India with the sensibilities of the historian, the work before us gives no sign of having been conceived in accordance with what his contemporaries understood as history In its narrow sense *tā'rīkh* is an era-work, and earlier in his career Bīrūnī had given obvious evidence that he could deal with history in the sense of "eras" (tawārīkh) His *Chronology of Ancient Nations*, as the work is called in its familiar English translation, is in fact the most sophisticated work of its kind in Arabic Bīrūnī had no peer in this critical investigation of widely varying traditions against a complex mathematical and astronomical background that rendered them all comparable.

Tā'rīkh meant more than the study of eras, of course, it was also used of works that took an established chronological line and arranged alongside the historical narratives (*akhbār*) of a people, a dynasty or a ruler Bīrūnī wrote two such works, the annals of (*tā'rīkh*) Maḥmūd and his father* and a book of "conversation" on the history (*akhbār*) of his native Khwārizm ** Neither work has survived, but nothing we know about them suggests an affiliation with the *India* Nor is there much visible resemblance between the *India* and the classical "annals" of Islam, the *tā'rīkh* of Ṭabarī, for example Bīrūnī neither belonged to nor aspired to belong to the *muhaddith* tradition in history, the world of *isnāds*, where authority rested upon names rather than upon demonstrative proofs, was alien to him

It is perhaps more pertinent to compare Bīrūnī with Mas'ūdī The *Golden Meadows*, an encyclopedic world history whose seventh chapter is given over to India, was written some twenty years before Bīrūnī's birth, and despite its obviously wider scope, it was set down in somewhat the same spirit as the *India* Mas'ūdī had been to Sind, where he must have collected historical information, knew the earlier Arabic translations of some Sanskrit works, and had the help of Muslim predecessors like the geographer-historian Ya'qūbī, the travel editor Abū Zayd al-Sirāfī and two early heresiographers, the Mu'tazilite Abū al-Qāsim al-Balkhī† and the Shi'ite al-Hasan ibn Mūsā al-Nawbakhtī‡, who supplied him with information on the sects of India

In his seventh chapter Mas'ūdī does attempt to follow a rough chronological line, as he does in the *Meadows* as a whole, and weaves into it information on geography, political history and institutions, manners and religious customs, religious and philosophical theories But here as elsewhere it is often impossible to tell where Mas'ūdī is giving oral traditions and where he is simply incorporating large blocks of material from his Muslim authorities

Even if expanded to the scale of Bīrūnī's work, Chapter Seven of the *Golden Meadows* is not the prototype of the *India* Bīrūnī obviously cared a great deal about chronology, but he was not very concerned to organize his material along a chronological line in the *India* He too could write summaries of Indian political history (II, 10—14), and in a clearer and more interesting way than Mas'ūdī But this is not his method, which is to quote from the Sanskrit material itself The quotes are not verbatim, to be sure, since many of the originals were in verse (as his own translations of Euclid and Ptolemy into Sanskrit had to be), and Bīrūnī complains more than once how difficult this rendered their understanding (I, 37) The reader is brought, in any event, face to face with the Hindu

*No 150 of Dr Ahmed Saeed Khan's bibliography
***Ibid*, No 160
†Sezgin, *GAS* I, 622-623
‡*Ibid* I, 539—540

scholars and theologians themselves, something that never occurs in the *Golden Meadows*

In his introduction (I, 5—8) Bīrūnī explains the genesis of the *India* It arose from a complaint about the Muslim heresiographies that purported to give an exact description of creeds and sects but fell far short of that ideal The information available on Hinduism was a case in point reports on it were generally uncritical and so unreliable Bīrūnī mentions the example of Irānshahrī, an author who has excellent material on the Jews, Christians and particularly the Manichaeans but who, when he came to speak of Hinduism and Buddhism, relied on an inferior source. The outcome of this discussion was that Bīrūnī was himself prevailed upon "to write down what I know about the Hindus as a help to those who want to discuss religious questions with them and as a repertory of information for those who want to associate with them"

We know little of what to make of this enigmatic reference to Irānshahrī Bīrūnī wrote the *India* sometime about 1032, nearly half a century after the *Catalogue* of Ibn al-Nadīm, seventy-five years after the *Golden Meadows* and considerably later than the sources of those two works Both works, and the sources upon which they rested, Abū al-Qāsīm and Nawbakhtī for Mas'ūdī and an anonymous author of the time of Hārūn in the case of Ibn al-Nadīm, provided material on the beliefs and practices of the Hindus, all of which Bīrūnī either did not know or ignored in favour of Irānshahrī, an author who, like another of Bīrūnī's favourite authorities, Muḥammad ibn Zakarīyā' al-Rāzī, was scarcely a Muslim at all

The *India* appears, in any event, to have a dual purpose, to provide an appropriate and accurate description of Hinduism for those who wished to engage in religious discussions as well as some broader information for those Muslims who were going to "associate" with them in some not very specific context It is difficult to think of the *India* as a handbook for Ghaznavid administrators It does discuss Hindu marriage customs for example (I, 107—110), though hardly for disinterested motives They have been set down, Bīrūnī explains at their conclusion, so that the reader may learn "how much superior are the institutions of Islam and how much more plainly this contrast brings out all their customs and usages, differing from those of Islam, in their essential foulness"

A glance at the contents of the *India* suggests that Bīrūnī had a quite different audience in mind, men who would read what he had written in libraries and *majālis*, scholars rather than administrators or tourists What elements of Indian culture had been or likely would be of interest to the scholar rested with Bīrūnī of course, and not unnaturally he chose to focus the *India* at the centre of his own interest, the mathematical quadrivium and particularly the astronomical sciences

The *India* is to be then, if we have understood Bīrūnī's purpose correctly, part heresiography and part scientific handbook And it is to be written, Bīrūnī continues (I, 7), not from a polemical point of view but as a "simple historical record of facts" The only embellishment he will permit himself is a comparison with similar theories of the Greeks or with those of the Ṣūfīs or one another of the Christian sects that bear a marked resemblance to Hinduism

At first sight this appears strange, that he should compare Hinduism with Greek culture rather than with his own creed of Islam But given Bīrūnī's view of truth and falsehood, no other course is possible Hinduism and Hellenism are comparable not because they borrowed from each other, as is true in the case of Manichaeism (I, 54, 31), but because heathenism does not suffer essential distinctions it is one with itself in its deviation from the truth (I, 24) And that is also the reason that Islam and Hinduism are not, strictly speaking, comparable, the first is the truth of monotheism and the latter is the falsehood of idolatry

If the Greeks and the Hindus are comparable in their errors, they are by no means identical They differ along another line of tension that Bīrūnī can trace in the history of culture and religion, that between the enlightened elite and the cruelly ignorant masses Bīrūnī underlines that distinction more than once in the *India*, but he does not dwell upon its logical consequence truth, or monotheism, is also one and it can be achieved not only by revelation, and it was in Islam and originally in Judaism and Christianity, but also by the intellectual *mujtahid* already familiar from the writings of Rāzī, the philosopher The Greeks provide the critical example (I, 24-25) There arose among them a class of enlightened philosophers who fought free from the innate idolatry of the masses to an understanding of the truth Witness Socrates who attempted to educate the Athenian masses away from idolatry and was put to death by them for his pains

The efforts of the Greek philosophers were only partially successful (I, 8), but they accomplished far more than their fellows in India Here too there were philosopher-scientists, and if one looks into their theological writings, one can detect there the truth of monotheism (I, 27) But as soon as one turns from them to the beliefs of the common people, one is confronted once again with the same "hideous fictions" (I, 32) that one can see in the popular mythology of the Greeks, in the perversions that have taken over in Judaism, Christianity, Manichaeism (I, 111) and even, Bīrūnī concedes, in Islam itself which is not immune to ignorance and distortion (I, 32)

The distinction between the enlightened elite and the ignorant masses is common to all cultures (I, 27) The first are the men of science who are characterized by their understanding of the truth in terms of general principles, while the "wisdom" of the masses is expressed in derived, secondary forms, in mythology

and anthropomorphism This was, of course, a commonplace in the Greek philosophical tradition which in its later stages was densely populated by Platonizing mathematicians, and when Bīrūnī takes up the question *in extenso* in Chapter Three of the *India*, the Platonic *testimonia* are put on full and obvious display But even though the distinction is a universal one and there were examples in abundance that could be drawn from among the *falasifah* and Ṣūfīs in Islam, India presents a special case in Bīrūnī's eyes India too had its philosopher-scientists and had made, in addition, large drafts upon the Greek scientific tradition Why then were their efforts less successful than those of the Greeks?

Bīrūnī was a believer in the contagious quality of the truth As one who had learned his own science from the Greeks, he could hardly have been otherwise And why else would he have translated Euclid and Ptolemy into Sanskrit (I, 137)? Some at least of the Brahmins were privy to the truth, whether through their own efforts or because they learned it from the Greeks But it could not be sustained, and what one observes in India is often the very reverse of Bīrūnī's most convenient and visible criterion of the truth, the customs and practices current in Islam (I, 17)

One of Bīrūnī's distant Greek predecessors, Herodotus, was likewise troubled by the disparity of customs between the Egyptians and his Greek countrymen (*Histories* II, 35-36) But Herodotus had neither monotheism nor Platonism to serve as his guide to the truth He was, rather, a naturalist (*physikos*) who conducted his "inquiries" (*historiai*) out of the conviction that nature, the internal principle of things, could be made to yield an understanding of cultural differences between peoples For Herodotus nature governed the growth not only of inanimate things but of the deeds of men, their history and customs The Nile behaves differently from all other rivers and so, in consequence, do the Egyptians vis-a-vis other peoples To find the key to an understanding of the Nile in the workings of nature is to unlock the mysteries of the Egyptians' behavior

Bīrūnī too believed in nature as a force with power and purpose, and in the *Chronology* he invokes it to explain what might appear to be physical prodigies, animals with supernumerary or defective organs (*Chronology*, 92-93) But nature is not used in the *India* as an analytical tool for the understanding of Indian customs or why they differ in such an obvious fashion from the Muslims (I, 179—185) Nor does he invoke another explanation that lay ready to hand At least since the time of Ptolemy's *Tetrabiblos* some astrologers had sought to explain regional and ethnic differences by resort to the astral influences predominant over the various *climate* of the earth Book Two of the *Tetrabiblos* is filled with such ethnographic astrology, and Bīrūnī, who knew and cited the Arabic *Tetrabiblos*, set out in the *Elements of Astrology* his own detailed version of the association of the planets and zodiacal signs with the various climes (*Elements*, 242), moral behavior (ibid , 251) and even religions (ibid , 253),

though Hinduism does not appear in this latter distribution In the *India*, however, which must have been composed about the same time as the *Elements*, Bīrūnī is silent on this possibility

In setting aside the planetary explanation of cultural differences Bīrūnī may have been expressing his well known reserve on the efficacy and limits of astrology (*Elements*, 210, 332) But his motive in not seeking for a natural explanation in the manner of Herodotus may have been the result of a deeper scientific agnosticism Natural peculiarities doubtless rest in the essential elements of things, but to trace their causes is to return to the very act of creation, a patent impossibility (*Chronology*, 235) In an experiment that once again reminds one of Herodotus (cf *Histories* II, 2-3), Bīrūnī proved to his own satisfaction that Hindu behavioral patterns are not acquired but innate Hindu boy slaves, who are captured before they can be taught to act in a certain fashion, inevitably do things in a manner almost exactly opposite to the ways of the Muslims (I, 185)

The Hindus could perhaps have cured their perversity and ignorance by contact with the science of Greece or the revealed truth of Islam, but their pride and xenophobia hampered their understanding of the first (I, 23, where Bīrūnī cites his own experience as evidence), while political hostility had damaged relations with the latter (I, 21-22) The price was a considerable one The Hindu scholar had to conspire in error and conceal from the masses his own discovery of the truth, he told them what they wanted to hear (I, 264-5, 273, 393) And the results were plain to see Greek learning was based upon independent research and the strict deductive method that is the hallmark of true science (*Chronology*, 61), while the Brahmins' version relied upon tradition and *taqlīd* or else resorted to divine inspiration Hindu science was filled with silly and erroneous notions, a mixture of pearls and dung, as Bīrūnī calls it (I, 25)

Bīrūnī was not unsympathetic with the problems posed by the conflict between religious beliefs, which in the Hindu case were dictated by popular ignorance, and the findings of science He muses long over the case of Brahmagupta (II, 110—113) who opened his discussion of eclipses in his *Brahmasiddhanta* with an affirmation of the Brahmins' *mythological* explanation of the phenomenon It must be thus, says Brahmagupta, because the *Veda*, which is the word of God from the mouth of Brahman, says so, and the generality of people agree To deny it, as some Indian scholars had done, and to suggest that eclipses have natural astronomical causes is the rankest heresy In Bīrūnī's view Brahmagupta knew perfectly well the causes of eclipses, just as Varamihira did, but while the latter scholar rejected the mythological account in the name of science, Brahmagupta preferred the *Vedas* and rejected the naturalistic account as heresy The reason, Bīrūnī suggests, was fear it is not everyone who has the courage of a Socrates

Bīrūnī himself may well be acquitted of the scientific sins of Brahmagupta; if he has failings, they fall elsewhere Bīrūnī was perhaps too engaged a scientist to be a totally satisfactory historian As history the *India* sinks beneath the combined weight of the Hellenic quadrivium and the author's avowed intent of writing a kind of Hindu heresiography We are given a full and graphic account of Hindu beliefs and practices, and in the Hindus' own terms It is an extraordinary achievement, this scientific heresiography, but the price was exacted from India's other sects and creeds Bīrūnī argued cogently and well for the important connection between Hindu-religious beliefs and the surrounding body of Indian science But once having brought us to this path, he gives free rein to his own interests A few pages on the *Vedas* (I, 125—130) is followed by a detailed chapter on Sanskrit metrics (I, 135—151) It is difficult to argue that for Bīrūnī metrics revealed more of the essence of Indian culture than did the *Vedas* what is far more likely is that the metrical problems interested and challenged him while the Vedas did not

Bīrūnī is unmistakably a literary historian, that is, he got his considerable knowledge of India from literary sources His grappling with the sacred and profane scriptures in Sanskrit is remarkable and an obvious advance over Mas'ūdī's and Ibn al-Nadīm's reliance on secondary authorities But Bīrūnī's concentration on texts effectively excluded the oral traditions where, presumably, the *akhbār* of India's political history were transmitted And though there are some perceptive remarks on descriptive geography in the *India* (I, 196—212), Bīrūnī took his principal pleasure in mathematical geography in the manner of his master Ptolemy The wild variety of Indian ethnography, which demanded a Herodotus or a Tacitus, is passed over in silence Bīrūnī was obviously more concerned with establishing the coordinates of Indian cities than in describing the life that went on within them

"It is man's nature to count", says Bīrūnī in the *India* (I, 160), and the central core of that work, Chapters XIV—LXII, testify to how well Bīrūnī could do his sums and amend the counting of others But fortunately for us he regarded himself as something more than a *zoon mathematicum*, and the *India* verifies another wiser aphorism from one of Bīrūnī's authorities Aristotle in his *Metaphysics* had remarked that "all men by nature desire to know", and it was in the grip of that truth that Bīrūnī not only counted but learned Sanskrit, read the *Puranas* and labored to interpret the culture of India to the world of Islam

MODERN AL-BĪRŪNĪ*

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THE author cites references from George Sarton, Prof Upham Pope and Eduard Sachau to throw light on al-Bīrūnī's high significance among the scholars of his time, his true scientific qualities, and his concept of freedom The author disagrees with Dr Sachau with regard to his opinions that al-Bīrūnī was forced to serve Sulṭān Maḥmūd of Ghaznāh because his home province was annexed by the Sulṭān, and that al-Bīrūnī did not enjoy freedom of action in Sulṭān's rule His reasons for disagreement are on grounds that long before the conquest of Khwārizm, Maḥmūd had desired for al-Bīrūnī at his court If al-Bīrūnī was subjected to any ill treatment he would not have accompanied the Sulṭān to India on so many occasions The dissatisfaction voiced by al-Bīrūnī at some places in his literary works, only displays a general trend of intellectuals who always seek complete independence Al-Bīrūnī has, however, never mentioned anywhere that he was kept a prisoner under Mahmūd If Ibn Khaldūn's historical volumes are studied, it becomes amply clear that he was above racial prejudices He was also critical of Arabs But even so his quoting al-Bīrūnī's historical works of Maḥmūd's Indian exploits is more a glaring pointer to his unprejudiced commentary unmarred by religious affiliations Al-Bīrūnī dedicated his book in the name of Mas'ūd because Maḥmūd had died before the book was completed, and not because of any other reason Machiavelli also dedicated his book "The Prince" in the name of the ruling prince Al-Bīrūnī was not afraid of telling the truth When the doubtful ruby which Maḥmūd brought from Nahora was shown to al-Bīrūnī he commented that it was of poor quality, even though it displeased Maḥmūd

On these evidential contentions the writer stresses that al-Bīrūnī was his own sovereign and his criticism of Sulṭān Maḥmūd was not to win the blessings of the new ruler

On the problems of methodology, the author quotes a number of scholars with regard to al-Bīrūnī's ability in languages, and asserts that besides full command in Arabic and Persian, he also knew Greek to be able to read Homer's *Iliad* in

*This is an abstract of the original paper

its original Greek version The same notions on methodical study prompted him to learn Sanskrit and study Indian literature in original language This also helped him to make comparative studies thus taking his methodology towards greater factuality Al-Bīrūnī's book *Indica* has been cited from various aspects to establish this point, and also to prove the true spirit of honest historiography that guided al-Bīrūnī all through this work

In conclusion al-Bīrūnī has been given sufficient justification to be described as a prince-historian of modern age

AL-BĪRŪNĪ IN GERMANY

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THE millenary birthday of al-Bīrūnī, one of the most outstanding medieval scholars, is rightly being celebrated in all parts of the Islamic world The reason may be the geographical situation of his birthplace Khwārizm, as in the case of Uzbekistan of the Soviet Union, the Persian language he spoke and the regions in which he spent so many years of his life, namely Iran and Afghanistan, the significance of certain works of his for the understanding of religious conditions in Eastern Islamic countries, an aspect important, let us say for Pakistan, or Arabic, the language of his books, at least inasmuch as they are preserved, a reason obviously interesting to Arabic speaking peoples But I think that all these facts are of minor importance compared with his personality, representing Muslim thought and scholarship, both arts and sciences in a unique synthesis His achievements belong to the whole Islamic world, irrespective of linguistic, ethnic or regional differences to such an extent that there can be no question of rivalry as to his belonging to one or the other Islamic country

But the triumph of al-Bīrūnī's works, of his ideas and views, was not confined to the "Dar al-Islam", it penetrated also as far as the western world, where distinguished scholars studied his treatises and discussed his theories This is, however, a privilege shared by many representatives of Islamic learning whose writings were objects of intellectual curiosity among European scholars as early as the eleventh and twelfth centuries when pioneers of Humanism and the Renaissance, in quest of the texts originally written by Greek philosophers, physicians and scientists, came across certain Arabic authors whose books contained those works not only more completely, but also in better versions than manuscripts preserved in European monastery libraries It was the time when a large number of Arabic books were translated into Latin, above all in Monte Cassino and Toledo Those translations formed, as is well known, over a long period the basis for scientific progress in Europe

This reception of Greek literature in the Arabic language had already begun during al-Bīrūnī's lifetime Nevertheless this was not, as far as we know, the way by which his writings came to Europe, although their contents would undoubtedly

have been of the greatest interest to the humanists, and that not only on account of their relation to Greek science which is apparent e g in his dependence on Ptolemy At any rate no Latin translations of his works are known to us His discovery by European scholars was to come about much later It is not due to the humanists, but to orientalists, in particular of the 19th century They incorporated al-Bīrūnī into oriental studies as a subject of research in numerous countries, where he finds new disciples even in our day

This paper is devoted to a limited sector of this process, namely the German share in al-Bīrūnī research [1] It was inaugurated by several comprehensive publications of Edward Sachau (1845—1930), a professor of Berlin University The first of these dealt with Āthār al-Bāqiyah, the text of which he edited in 1876 and 1878 in Leipzig under the title "Chronologie orientalischer Voker" For the translation he had the assistance of Ferdinand Wustenfeld (1808—1899), so far as Arabic language problems were concerned, whereas he had recourse to expert astronomers and mathematicians for technical questions The incentive for this publication, edited by the German Oriental Society, had been a commission for an English version entrusted to him by the Oriental Translation Fund of Great Britain and Ireland, a task which he fulfilled in 1879 with his "Chronology of Ancient Nations"

The Committee of the Oriental Translation Fund had already before included in its programme al-Bīrūnī's book on India, the value of which had been pointed out as early as 1849 by Josef Reinaud (1795—1867) Originally the edition was to have been prepared by Franz Woepcke (1826—1864), a leading expert on Arabian mathematics, and Baron MacGuckin de Slane The latter then pressed Sachau to undertake this task The Arabic text appeared in 1887 in London Sachau translated it first into German But this translation seems never to have been published, apparently because it had been conceived as a preliminary to the two-volume English translation brought out, also in London, only a year later than the text edition

The merit of having placed al-Bīrūnī research on a solid foundation is due to Sachau, who also wrote several articles on individual problems of the *Ustadh* This merit is neither diminished by the fact that his edition and translation of the "Chronology of Ancient Nations" had to be based on three recent and faulty manuscripts, whereas better and more complete manuscripts came to light later on, nor can progress of Indian studies rendering necessary certain corrections in his "Book on India" be regarded as detrimental to it It is almost as if Sachau himself had foreseen this development when he wrote "the work of generations will be required to do full justice to Alberuni" (Chronology, 1879, p VI)

The appeal for further scholarly endeavour to make accessible al-Bīrūnī's works implicitly contained in these has not been ignored in Germany Still in

Sachau's lifetime, i e before 1930, a number of distinguished scholars published the results of their research work on various of al-Bīrūnī's treatises A contemporary of Sachau, Eilhard Wiedemann (1852—1928)[2], professor of physics at Erlangen University, must be given a place of honour among them He gained renown as the author of numerous contributions to the history of science in medieval Islam He treated as many as seventeen of al-Bīrūnī's writings, partly in German translations, partly in learned commentaries, occasionally together with expert colleagues, but in general alone or by stimulating students and collaborators Many of his publications appeared in "Sitzungsberichte de Physikalisch Medizinischen Sozietat zu Erlangen" as a series under the title of Contributions to the History of Natural Sciences, others in quite a lot of periodicals, the titles of which indicate the extent of the interest in al-Bīrūnī in the world of learning of those times He took al-Bīrūnī's works as a basis for his investigations on geographical and geodetic questions in the description, measurement and revolving of the earth, mineralogy and specific weight, observations of solar and lunar eclipses and on other astronomical and trigonometrical problems

In co-operation with the Swiss mathematician, Heinrich Suter, Wiedemann published in 1920/21 a study on al-Bīrūnī and his works ("Uber al-Bīrūnī and seine Schriften"), supplemented later on by the list of works ("Epitre", Paris 1936) compiled by Paul Kraus (1907—1947) and arranged according to al-Bīrūnī's own catalogue This bibliography remained valid for nearly twenty years, until it was finally replaced by Reverend D J Boilot's well-known "Essai bibliographique" As early as 1912 Wiedemann had published a brief biography of al-Bīrūnī ("Biographie von al-Bīrūnī') in the above mentioned "Sitzungsberichte" (Erlangen), which he brought out in an enlarged and revised edition jointly with Joseph Hell (1875—1950) professor of Arabic at Erlangen University, in "Mitteilungen zur Geschichte der Medizin und Naturwissenschaften" Thirty years later two excellent biographical sketches were written by Max Krause (1909—1944) and Max Meyerhof (1874—1945) The latter appeared in "Bulletin del' Institute d'Egypte" (Vol XXII, 1940), the former in "Der Islam" (Vol XXVI, 1942) Both were forerunners of the recent biography "Zizn'i trudi Beruni" by Pavel Georgievich Bulgakov (Tashkent 1972, 428 pages)

Wiedemann had repeatedly dealt with subjects from "al-Qānūn al-Mas'ūdī" An eminent successor in this field was the astronomer Carl Schoy (1877—1925) He made his debut with minor contributions to this magnum opus, among which his article on the astronomical geography of the Arabs, original studies from al-Qānūn al-Mas'ūdī ("Aus der astronomischen Geographie der Araber, Originalstudien aus dem al-Qānūn al-Mas'ūdī") deserves special mention Then he ventured on the momentous task of paraphrasing and commenting on a comprehensive integral chapter He gave it the title of the trigonometrical theories of the astronomer al-Bīrūnī ("Die trigonometrischen Lehren des persischen Astronomen al-Bīrūnī") But he did not live to see its publication After his death it was seen through the press by Julius Ruska and Heinrich Wieleitner (Hannover

1927, XII and 108 pages) Even more tragic was the fate of Max Krause, a young arabist and mathematician of Hamburg University, who had completed the manuscript for a critical edition of the whole "Qānūn al-Mas'ūdī", when he died in action during the Second World War, before having been able to arrange for the printing His edition has never seen the light of day

A translation of the "*Kitāb al-Ṣaydanah fi al-tibb*" met with the same fate It had been made in 1943 by Max Meyerhof (1874 to 1945), Cairo optician, born in Hildesheim Earlier (in 1932) he had edited the introduction to al-Bīrūnī's pharmacology ("Das Vorwort zur Drogenkunde des Beruni"), Arabic text with German translation and commentary Since 1941 he had been working on a complete edition of the "Ṣaydanah", but he could not finish it On the other hand we owe to him several articles on subjects of this pharmacology

Julius Ruska (1867—1949), another German scholar who gained a reputation as an expert in Islamic alchemy, dealt from time to time with al-Bīrūnī, particularly in connection with his studies on Rāzī ("Isis" V, 1922 "Der Islam" XXV, 1939) His main interest was the book of precious stones, "*Kitāb al-Jamāhir fi Ma'rifah al-Jawāhir*" Later on this work played a certain role in the Oriental Department of Bonn University, where Paul Kahle (1875—1964) created a centre of al-Bīrūnī research in the thirties Bonn Oriental Department turned out to be a centre of attraction for scholars of various countries, who had either already worked on the *Ustadh* or received the stimulus to do so from Paul Kahle He himself had studied fragments of Chinese porcelain, found in refuse heaps near Cairo These had given him the inspiration for investigations on the treasures of the Fāṭimids ("Die Schatze des Fatimiden" ZDMG 89, 1935), which in their turn brought him to the above mentioned book on precious stones He used it for his articles on Islamic sources for Chinese porcelain ("Islamische Quellen zum Chinesischen Prozellen", ZDMG 88, 1934) and on rock crystal, glass and molten glass ("Bergkristall, Glas und Glasflusse nach dem Steinbuch von el-Beruni", ZDMG 90, 1936) Among Kahle's colleagues in those days was Professor Fritz Krenkow, the renowned expert on ancient Arabic poetry To him we owe a critical edition of the "*Kitāb al-Jamāhir*" (Hyderabad-Dn 1936) Moreover he wrote several detailed studies on al-Bīrūnī Another visiting professor of Bonn University, the famous Turkish scholar Ahmed Zekī Velidi Togan (1890—1970), who became later an outstanding personality in al-Bīrūnī research, was then busy with his "Northern Peoples according to al-Bīrūnī" (Die Nordvolker bei Bīrūnī) and used the book of precious stones for his articles on the swords of Germanic tribes (Die Schwerter der Germanen both articles in ZDMG 90, 1936) Moḥammed Yaḥyā Hāshmī worked under Kahle's supervision on his thesis, Sources of al-Bīrūnī "*Kitāb al-Jamāhir*" (Die Quellen des Steinbuches des Beruni", Grafenhainichen, 1935) and Taqī al-Din al-Hilālī's Berlin thesis on the introduction of the "*Kitāb al-Jamāhir*" ("Die Einleitung zu al-Bīrūnī Steinbuch, Leipziq 1941) seems also to be the fruit of a suggestion of Kahle's

The Second World War entailed a serious setback for German al-Bīrūnī research But it has since gained new disciples in the ranks of orientalists We want to mention Hellmut Ritter (1892 to 1971) with his publication of Patanjali's Yoga-Sutra ("al-Bīrūnī's Ubersetzung des Yoga-Sutra des Patanjali", Orients 9, 1956), which he treated also in papers read in Damascus and Teheran His text edition is based on a unique Istanbul manuscript, brought to light in 1922 by Louis Massignon and then treated, in a preliminary report (OLZ, 1930) by Jakob Wilhelm Hauer (1881—1962), an indologist of Tubingen University Other contributions to the publication of texts are due to Karl Garbers (born 1898) and Hohann Fuck (born 1894) namely supplements to Sachau's edition of the "Chronology" ("Der Islam" XXX, 1952, Documenta Islamic Inedita", Berlin 1952) Finally a study has been produced by Willy Hartner (born 1905) and Mathias Schramm on "Al-Bīrūnī and the Theory of the Solar Apogee, an example of originality in Arabic Science" (Scientific Change, ed by C Cromby, London, 1963)

Apart from all these special studies, publications and treatises, mention should be made of summaries on al-Bīrūnī in Carl Brockelmann's (1868—1956) "Geschichte der Arabischen Literature", Fuat Sezgin's "Geschichte des Arabischen Schrifttums" and Manfred Ullmann's (born 1931) contributions to the "Handbuch der Orientalistik"

Within the framework of a brief survey it is impossible to give a more detailed characterization of all German contributions to the works of the *Ustadh* We have not even been able to include the names of all scholars who participated in them, nor have we listed all publications of those whose names have been mentioned The examples cited above may, however, give sufficient evidence of the fact that the Persian master is not only far from being unknown in German scholarly circles, but that he has become, so to speak, naturalized in my country Of course, he is not a popular personality in Germany But he has a settled place in German culture, and German Orientalists therefore take a keen interest in the celebrations being held in the world of Islam and elsewhere on the occasion of millenary of his birthday

Al-Bīrūnī in Germany To the characteristics of this subject belong the close co-operation between German and oriental scholars, between men of letters and the representatives of natural science Not only arabists had their share in it, but also philosophers and indologists, physicists, mathematicians, astronomers, medical experts and pharmacologists The universal and original genius of al-Bīrūnī reminds us of a famous personality in German history, Gottfried Wilhelm Leibniz, who just like the Persian scholar, admittedly seven centuries later, is distinguished for his achievements in various spheres of learning, both in arts and sciences, the influence of which was still alive many generations after his death And the intellectual pre-occupation with his works and ideas, shared by scholars of many countries, is still today far from its conclusion, just as in the

case of al-Bīrūnī Like the Persian scholar, Leibniz did not write his numerous works in his mother-tongue, in his day the scholarly language in his country was Latin In his case too there were and still are problems of textual criticism A special Leibniz Commission of the Berlin Academy of Sciences has produced significant contributions to their solution We wonder whether an al-Bīrūnī Commission, if it were established, could not be of the same value in the publication of hitherto unpublished or not satisfactorily edited works, in the collection and evaluation of the comprehensive al-Bīrūnī literature, dispersed over so many countries in so many languages

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[1] For full bibliographical details see D J Boilot, "L'Oeuvre d' al-Beruni Essai Bibliographique", MIDEO II (1955) p 161—256 and III (1956), p 391—96, Johann Fuck, Die arabischen Studien in Europa bis in den Anfang des 20 Jahrhundert Leipzig Harrassowit 1955, Rudi Paret, The Study of Arabic and Islam at German Universities German Orientalists since Theodor Noldeke Wiesbaden Steiner 1968

[2] Messrs Olms have recently started a new edition of Wiedemann's treatises So far two volumes containing the articles published in the "Sitzungsberichte" have appeared Eilhard Wiedemann, Aufsatze zur arabischen Wissenschaftsgeschichte, mit einem Vorwort und indices herausgegeben von Wolfdietrich Fischer Hildesheim-New York, 1970 (Vol I and II) The first volume, p XIII—XXIV, gives a biography and a bibliography of Wiedemann written by H J Seemann

BĪRŪNĪ AND BAR SHINĀYĀ

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IN 1909, I -B Chabot, the editor of the Syriac text of the *Chronology* of Bar Shinäyā, wondered about the relationship between this work of Bar Shinäyā and the Chronology of Bīrūnī In 1910 in the preface to the Latin translation of Bar Shinäyā's *Chronology*, he decided that his guess the year before was wrong and there is no relationship between the two works This statement, as we will see later, is indeed correct

In this talk I will concentrate on the evaluation of the two works and will conclude by an appraisal of Bīrūnī's *Chronology* from the point of view of the usefulness of both works as primary historical sources To start with, the work of Bīrūnī is indeed unique in that period in that it deals with problems of comparative religion in the most objective, detached and scholarly manner The work of Bar Shināyā, on the other hand, cannot claim that for it is a continuation of a traditional *genre* of writing known to have been done by other people such as Hyppolytos (second century A D) Anatole, the bishop of Laodicea (middle of the third century), Diodorus, Bishop of Tarsus (end of the fourth century), and George, Bishop of the Arabs (eighth century) to name only a few

For Bīrūnī, a chronology is a scientific work, in the modern sense of scientific comparative religion, in which he attempts to study the vestiges of the past by presenting the known facts and then evaluating them When the facts are intricate and the religious dogmas are contradictory and the issues cannot be settled historically, Bīrūnī says so and refrains from judgement His purpose in the *Chronology* is to preserve the *Āthār*, to understand the essence of the religious institutions that man had erected and very respectfully gives his reader a picture of the religious practices of the different religions that he had studied To him the subject is important for it contributes to the understanding of bygone and contemporary civilizations and hence to the understanding of man within the framework of his social institutions

Bar Shināyā, one the other hand a contemporary of Bīrūnī, is a bishop of

the Nestorian Church, a representative of a minority group in the large Muslim empire of the late tenth—early eleventh century, an advocate of the Nestorian dogma and practices and hence is a recorder of the "Orthodox" institution His purpose is to establish the orthodox practices and hence to establish the Canon Law concerning the most significant commemoration of the Christian church in general, i e Easter The problem is indeed dealing with the essence of Christianity, namely the concept of resurrection, and the bishop feels that it is his duty to establish its determination From a computational point of view, for Easter is determined by luno-solar cycles, the problem requires many dogmatic antecedents and entails many consequences Hence the result is a work of more than sixty folios pivoted around the Easter problem

To be fair then, we should compare the whole work of Bar Shināyā with the sections in Bīrūnī's *Chronology* that deal with the Christians We can't expect the bishop to be as informative as Bīrūnī on the ancient Persian practices or the pagan Greek practices for his purpose is simply limited to the Christian church problems His purpose, as he says in the introduction is to describe the methods of computations for "the years and feasts" What he really means is that he will describe the various calendars used by Christian communities and establish the feasts, i e the religious calendars for them A look at the contents of both works will facilitate the comparison and will give those who are not familiar with them a better grasp of the discussion that follows Bar Shināyā's *Chronology* can be fairly divided into two major sections (1) A discussion of the calendars of the Copts, the Syrians, the Persians and the Arabs, and (2) A discussion of the Christian feasts with a very short discussion of Jewish Passover which is an essential antecedent of Easter

In the first section he deals also with the interrelation of the various calendars, giving tables for the determination of the different elements of each calendar, such as tables of *madkhals* (ferias), and concludes this section by a concordance table that gives the equivalent dates for the first of March in the various calendars, for a period of 2836 years A typical equation in such a table gives the first of March in the year 2200 of Alexander as being (a) Wednesday, (b) 298 days of the current Coptic year had already passed, (c) 2636 years of the Nebukhadnassar years, by Coptic count (i e 365 days each) had already passed And (d) that was the 11th day, of the month of (e) Rajab of the year (f) 1306 of the Hijrah and (g) 208 days of the (h) 1258th Persian (i e Yezdigird) year had passed

There is no doubt that such a concordance table is the first of its kind and is indeed a very useful tool for both contemporaries of Bar Shināyā and medievalists of modern times It is not as comprehensive as the modern Mahler Wustenfeld tables but it is essentially conceived along the same lines Its purpose, however, is manifold, and could be used in conjunction with other tables to determine *inter alia* the dates of Easter

In the second section he deals essentially with two problems (a) methods of computation of Easter and other Christian feasts and (b) testimonies supporting those methods of computation Moreover, in a typical medieval style he gives alternative methods for the computation of feasts and in the elaboration of these methods he preserves for us material from earlier sources that are now lost such as the technical parts of the *Chronicon* of George, Bishop of the Arabs

Since Bar Shināyā was apparently writing for a Christian readership spread in small communities over the various parts of the vast Muslim empire it is only appropriate that he ends this section by giving concordance tables for the dates of the full moon that determines Easter in the Muslim calendar Bar Shināyā does indeed conclude his work by such tables

The comparable sections in Bīrūnī's *Chronology*, include a detailed discussion of the Jewish calendar that includes the discussion of Passover (chapters seven and fourteen) and a detailed discussion of the liturgical calendars of the various Christian sects (chapters fifteen, sixteen and seventeen)

In accord with Bīrūnī's eclecticism he gives a complete survey of the practices of the various important sects within both Judaism and Christianity Burnaby depends almost totally on this work of Bīrūnī in his study of the Muslim and the Jewish calendars His objectivity and scholarly detachment makes his work an extremely valuable primary source for the Jewish calendar Moreover, this work can be used extensively for any study of Jewish sects known at the time of Bīrūnī such as the Rabhanites, the Mīladites and the 'Ananites as well as other minor sects such as *Qurra*, Ishma'ites, *Hashwiyyat* and *Dahriyyat* It can be used with equal authority for any study of the differences in practices among the major Christian sects of the medieval times such as the Melkites, the Jacobites and the Nestorians

With a typical scholarly honesty of Bīrūnī, he admits that he does not know very much about the practices of the Jacobite sect for he neither met any of them nor did he hear about them I have stated somewhere else, that his knowledge of this sect has definitely increased between the time he wrote the *Chronology* and the time he wrote the *Qānūn* for in chapter nine of the second *maqālah* of the *Qānūn* he includes this sect with the others in his detailed comparative liturgical calendar

The sources of the chronology of Bīrūnī can be divided into three main parts (1) Technical sources such as *Almagest* of Ptolemy of the second century A D and the commentary of Theon of Alexandria of the fourth century A D Both of these texts are available in Greek and at least one modern European language In the same category of sources he also uses the works of the Ma'mūn astronomers such as Habash al-Hāsib, Banū Mūsā, Khālid b 'Abd al-Malik al-Marwarrudhī, and others He also uses the works of Abū Ja'far al-Khāzin (d 961-71), Thābit b

Qurrah (d. 901), Ibn al-Bāzıyar (fl 9th century), Sınān b Thābıt (d 943 A D), and others for less technıcal materıal (2) His sources for Judaıc and Chrıstıan practıces are maınly *Seder-'Olam* for the Jewısh chronology and the work of Abū al-Husayn Aḥmad b Al-Husayn al-Ahwāzī tıtled *Kıtāb ma'ārıf al-Rūm* The first of these sources ıs extant and was publıshed as early as 1699 by Meyer The work of al-Ahwāzī ıs lost to us and the quotatıons ın Bīrūnī are the only fragments preserved Both of these sources deal wıth relıgıous practıces and hence wıth relıgıous dogmas determınıng lıturgıcal calendars and theır computatıon (3) Fınally, Bīrūnī uses some general chronologıcal works for the dıfferent sects and the days of each of those sects Such sources ınclude works by people such as Sınān b Thābıt b Qurrah (d 943 A D), on meteorology and major events called *Anwa'*, Annıanus of Alexandrıa (5th century A D) who apparently wrote a book on chronology that was quoted by Ibn al-Bāzıyar, unknown from other sources, 'Abd al-Masīḥ b Isḥāq al-Kındī al-Naṣrānī (the Chrıstıan) as an authorıty on the Sabaean sect and who ıs dıfferent from the famous phılosopher al-Kındī as we wıll see below Of the works of the phılosopher Al-Kındī, he uses *Kıtāb al-Talwīh*, whıch ıs not extant Al-Ma'mūn b Aḥmad al-Salamī al-Harawī, unknown from other sources, has a work apparently dealıng wıth descrıptıons of the holy places ın Jerusalem whıch was used by Bīrūnī He also uses a commentary wrıtten by some Dadīshū' who was not ıdentıfied by Sachau We wıll dıscuss the ıdentıty of thıs Patrıarch below Fınally he uses sources of general nature such as the *Canons of the Apostles*, whose Arabıc copy was edıted and translated by Jean Perıer ın *Patrologıa Orıentalıa*, Vol 8 (1912), and other sources known as *Kannashat* of Syrıac *Kannashe* (compendıums)

Bar Shınāyā, on the other hand, uses a dıfferent set of sources sharıng wıth Bīrūnī only the technıcal work of Ptolemy *Almagest*, and the Canon laws of the Apostles on relıgıous dogmas On the whole, Bar Shınāyā contınues the tradıtıon of relıgıous wrıtıngs generally known as chronıcons Such wrıtıngs were known at a much earlıer date wıth Jacob of Edessa (640 A D —780 A D), and George, Bıshop of the Arabs (d 724 A D) The chronıcon of Jacob survıves only ın fragments and was publıshed by Brooks ın *Corpus Scrıptorum Chrıstıanorum Orıentalıum* (1904) That of George ıs lost to us

There were other chronıcons ın vogue by the tıme of Bar Shınāyā and Bīrūnī such as that of Sımeon Barqāyā (fl c 600 A D), and some chronıcon known as that of the Orıentals probably wrıtten by Anatole of Laodıcea (mıddle of the thırd century A D), to name only a few

By now we are begınnıng to notıce the essentıal dıfference between those two chronologıes whıch we have stated ın general terms at the begınnıng of thıs paper Furthermore, a close study of these two works, ın terms of theır sources, style and purposes wıll definıtely reveal the lack of any relatıonshıp between them If there ıs any common source or common result ıt would be only accıdental But ıt should be stated very clearly that Bīrūnī's work ıs completely

original for its time in scope and conception, for we don't know of any source treating the subject dealt with by Bīrūnī so comprehensively, and if we know of some sources they are all lost by now On the other hand, the chronology of Bar Shināyā is a continuation of a tradition already established by the end of the tenth century and beginning of the eleventh and its main importance lies in the fact that it quotes at length the earlier non-extant sources, and is in itself a complete representative sample of that *genre* of writing

Bīrūnī's knowledge of the Syriac language has been for some time a controversial issue After a close study of his *Chronology* it can be safely stated that his knowledge of Syriac was rather superficial and he did not really have a good grasp of the language The following comments will prove the point

(1) On page 268 of the text, page 260 of the translation he says "Both words *bāhūr* and *buhrān* in the Greek and Syriac languages are derived from a word which means the decisions of the rulers " Then he gives what can be at best called a popular etymology relating these two words to Arabic *bahr* (=sea) and contends that this etymology is more probable This linguistic comment neglects the etymological relationship to the Syriac root *bhar* (=to examine, to try, to observe) which is akin to the Arabic root *b h r* in the fifth form *tabahhara* (=to mediate, to think, to reflect) Syriac *bāhūrā* is an examiner There is no doubt then that we are dealing here with two genuine Syriac words that are not derived from Greek but from a Semitic root

The phenomenon described by these two words is actually a folklore type of weather-casting that predicts the weather of the rest of the year from the observation of the weather of few days during the summer season These days are known in colloquial Lebanese as *bawāhīr* and they start on Īlūl (September) 15th one day after the feast of the Cross It is interesting to note that Bīrūnī, *ergo* his sources, reckons those days from Tammūz (July) the 18th and Īlūl (September) the 15th as the Lebanese folklore still has it Bīrūnī, however, is aware of many traditions and he gives a summary of the various opinions in the section that follows

(2) Page 302 of the text, 299 of the translation he says that the word *jījal*, or cycle, is an Arabized Syriac word, in Syriac *Gīgal*, meaning the same as the Jewish *Mahzor* The original word is actually Greek Κvκλοʃ and is borrowed as *Gīglā* in Syriac and *jījal* in Arabic Hence the original word is Greek and not Syriac

(3) Page 308 of the text, 304 of the translation has the word paraclete translated as Holy Ghost The word is originally Greek πapakλnτoʃ which means intercessor and only Syriac *paraqlīṭā*, which is borrowed from Greek, describes the Holy Ghost as an intercessor But the Holy Ghost itself is called *Rūh Qudsā* in Syriac

Other words such as *Sullāqā, Tūr Zeitā, Mart Mariam, Ma"althā, Quddāṣ ciṭṭā*, are Syriac words used in Christian Arabic as religious technical terms and their use by Bīrūnī, does not prove his knowledge of Syriac one way or the other But from his doubtful derivations of some words and his silence on others we could safely say that his knowledge of Syriac was rather scanty

Bar Shināyā uses the same technical terminology in Arabic and Syriac alike He just transliterates words such as *Penṭeqosṭi, Sullāq, Shallih, Dukhrān*, etc from Syriac into the closest phonemes in Arabic Some of these transliterations in both works are extremely helpful from a linguistic point of view In the case of *Penṭeqosṭi* for example, we note that the lack of the phoneme in Arabic has forced the transliteration into Syriac 'p' which is akin etymologically to Arabic *fā'*, and is multiphonemic But as the word entered Arabic through Christian Arabic a transliteration of π with Arabic *bā'* became accepted We find Bīrūnī transliterating the same word once with *fā'*, Syriac style, and once with *bā'*, Arabic style (Text p 308)

Bīrūnī's transliteration of words such as *fsaltā*= (Psalter), Syriac style, *Qarūyā* (=Reader), *mṣamṣānā* (=Deacon) and Qasṣīṣā (=Presbyter), show that the final vowel used with the Syriac definite case-ending is a long ā not a long o

A transliteration such as *Mart Mariam* (Text, 308), shows that the first person possessive pronoun was lost phonetically in Syriac by the time of Bīrūnī, for etymological Syriac is *Martī Mariam*

Another transliteration such as *'ittā*, reflects the phonetic loss of the Syriac *d* when it occurs before *t*, hence its common Syriac spelling with *linea occultans* The Syriac etymological spelling is *'idta*

The length of Syriac vowels is also shown to be conditioned by accent rather than by a fixed length of the vowels Both words *Subbārā* and *Qarūyā* are usually spelled with the same long ū in Syriac, even though only the transliteration of the second word is done with *ishbā'*, i e the semi-vowel *waw* is used

Since the publication of Sachau's excellent commentary on Bīrūnī's *Chronology*, 1879, a great amount of work has been done in Islamic sciences and related desciplines The issues that were left unsettled by Sachau in the last century need to be reviewed in light of the new material

On page 205 of the text, 187 of the translation, Bīrūnī mentions the opinion of a certain 'Abd al-Masīḥ al-Kindī al-Nasrānī (the Christian) Sachau comments, p 419 that this al-Kindī "seems to be the famous philosopher of this name" But we know that Bīrūnī would refer to the famous philospopher by simply al-Kindī as he does on page 298 of the text (294 of the translation) This 'Abd al-

Masīḥ then must be a different person and we do indeed know of a certain 'Abd al-Masīḥ b Isḥāq al-Kindī al-Nasrānī in connection with a treatise sent to 'Abd-allah b Ismā'īl al-Hāshimī (Kaḥḥāla, *Mu'jam al-Mu'allifīn* vol 6, p 174, Sezgin, *GAS*, I p 612 Brockelmann, *GAL*, Sup I, p 345) The debates between this Kindī and Hāshimī were of religious nature and the works of Kindī are still available in manuscripts in Damascus and Beirut It is highly probable that Bīrūnī is referring to this Kindī, not the philosopher, when he discusses the Sabaean sect Sezgin seems to be of this opinion too (*ibid*) The other work of the philosopher Kindī, *al-Talwīh*, seems to be lost to us now

On page 299 of the text, Bīrūnī mentions a certain *Dādīshū'* in connection with the variant spelling of the prophet Iesaia He also says that this Dadishu is an author of a commentary on the book of Iesaia Sachau says in the commentary, p 437 that this Dādīshū' is unknown to him Now there are many Dādīshūs who could have been intended here We prefer to draw attention to the Patriarch of Seleucia and Ctesiphon (430—465 A D) who had this name and was mentioned in the Catalogue of Ebedjesu edited by Assemani (*Bibliotheca Orientalis*, vol 3 I pp 214-15) as the author of commentaries on the books of the Bible We do not have any reference to his work on Iesaia, but we do know of his works on Daniel among others (cf Duval, *Literature Syriaque*, p 71) Hence, it is most probable that Bīrūnī was referring to the works of this Patriarch which are no more extant

On page 204 of the text, Biruni refers to a work by a certain Ibn Sankalā, concerning the tradition about the Patriarch Abraham in Harrān Sachau hesitates to identify this Ibn Sankalā with Georges Syncellos (c 800 A D) the author of a *Chronographia* published by Dindorf in *Corpus Scriptorum Historiae Byzantinae* (vol 12-13) in Bonn 1829 This text includes the story of Abraham in Harrān (p 93f) and some translation of it must have been at the disposal of Bīrūnī It is somehow surprising that Sachau does not draw attention to this section of the *Chronographia* of Syncellos

On page 308, Bīrūnī mentions some table called seven lines table Sachau says rightly that this table is no more extant in the manuscripts of Bīrūnī's *Chronology* (Commentary p 440) Such a table was probably similar if not identical to the one preserved in the work of Bar Shināyā (fol 97r) which gives the *madkhal* (=feria) of any year in a 28-year cycle in an arrangement of seven possible ferias and then gives the corresponding days of all the major feasts during that year A full commentary on the construction and use of such tables will be published in another place in connection with the table of Bar Shināyā

On page 310 of the text, there is a mention of a Saint by the name (*fonia*) موريا which was left undeciphered by Sachau, p 440 In the publication of 1889, *Tresor de Chronologie*, by M Le Cte de Mas Latrie (col 907), *et passim* there is a mention of a third century saint from Antioch whose name is

Pionius which would be very close to the name in Bīrūnī's text when transliterated as فيونيا It is possible that this was the saint intended

What else can be learned from Bīrūnī's *Chronology*? In a marginal way Bīrūnī gives information that is relevant to history of science in general, history of the Church, anthropology as well as other fields of knowledge that cannot be easily classified in one discipline

While talking of the Jewish calendar and the use of lunar months, he reports the value of a synodic month as given by Ptolemy, the main source of Arab astronomical knowledge But in the same paragraph he also reports the values determined by Khālid b 'Abd al-Malik al-Marwarrudhī and Banū Mūsā Then he chooses to use the value given by Banū Mūsā as the most dependable for the construction of a luno-solar table giving the *moled* of Jewish years computed for the meridian of Jerusalem From such information we learn that the Arab scientists, by the time of al-Ma'mūn, early part of the ninth century, were already carrying their independent scientific activities and challenging the authority of Ptolemy This tendency culminated in the daring works of the Maragha school in the thirteenth century

Moreover we find Bīrūnī himself, recomputing tables for new meridians and hence producing original works after a long process of criticism and evaluation The question of the Jewish New Year (*Moled*) had to be settled as a function of a geographical meridian and luno-solar cycles Biruni's contribution there is his analysis of the problem and its dependence on a local meridian and then his computation of a table consistent with the given conditions

Besides the technical material Bīrūnī offers information of great importance for students of anthropology and cultural institutions After a discussion of the relative importance of Christian feasts in relation to commemorations he tells us that it was a Christian practice to give babies born on the day of a certain commemoration the name of the saint for whom the commemoration is observed He also supplies us with the relative importanc of religious offices, councils, synods and the like

From him we also learn that it was a man by the name of Berekhya who brought Christianity to Marw during the third century A D (p 299) Hence as early as the third century the work of missionaries had gone as far east as Marw

Then he has two references to a feast called the Feast of Roses The tradition behind it, as recorded in Bīrūnī's *Qānūn*, is that this feast commemorates the giving of roses to Mary, mother of Christ, by the mother of John, son of Zacharia Bīrūnī tells us that the feast was celebrated in Khwārizm, his native

region, by Christian Melkites (p 296) hence the fact that there was a practising Melkite community by the time of Bīrūnī in Khwārizm Second he says (p 299) that this same feast was celebrated in Khurāsān according to the new custom, hence the change of customs and laws within the Christian Church and Bīrūnī's record of them

Bīrūnī does not stop at a record of isolated events that reveal the structure of the Christian Church of his time but describes in detail the major Christian sects and compares their practices He gives us, for example, the names of feasts on which there is an agreement between the Melkites and the Nestorians (p 309) Earlier he had already listed the days and the feasts upon which these two major sects vary (p 288)

Moreover, the Christian sects to which Bīrūnī refers are not limited to the three major ones, but he includes even the minor schisms such as the followers of Bar Daisan, Marqion and Mānī (p 207) He also tells us of the peculiar practice of the 'Ibadites, a small Christian Arab tribe, as being the only ones who commemorate a fast called the fast of the Virgins Those Ibadites must have been descendants of the Christian Arab tribes of Southern Iraq, of the pre-Islamic times

After these few notes that included only the sections of Bīrūnī's *Chronology* that dealt with Christians and Jews we can easily see how comprehensive, detailed and scholarly is the work of this tenth century Muslim scholar In contrast with the works of church fathers such as the work of the Nestorian Bishop, Bar Shināyā we find that even when the information is scattered around in Bar Shināyā's chronology, it is gathered in tabular form in Bīrūnī's work to facilitate its accessibility

To recapitulate, I draw attention to the difference in purpose and scope between the works of Bīrūnī and that of Bar Shināyā Even though they were contemporaries, the work of Bīrūnī still stands as unique and original in its purpose, method of analysis and scope We have also seen that even the sections in Bīrūnī's work that are comparable to the work of Bar Shināyā for they deal with the same subject, are still more comprehensive, and are a much more useful source for church history In contrast the work of Bar Shināyā is indeed the record of the dogmas and practices of one Christian sect, namely the Nestorian sect This is not saying that the sect is not important or that the problems discussed by Bar Shināyā are trivial But it is indeed saying that Bar Shināyā was still in the Christian tradition of writing a chronicon, limited to a particular sect, while Bīrūnī is tackling a very original topic for his time and that is the subject of comparative religion

ABŪ AL-RAIḤĀN MUḤAMMAD IBN AḤMAD AL-BAYRŪNĪ 362/973—CA. 443/1051

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FOR over half a century al-Bayrūnī strove to impart knowledge to his contemporaries and to leave for his posterity as good an account of the sciences as was possible 1000 years ago But the man who has shed so much of light on so many obscure matters has had all sorts of half-truths and untruths told about his life and deeds Thus, he has been made to get born in all places right from al-Jurjāniyah in the north-west to the non-existent city of Bayrūn[1] supposedly in Sind in the south-east, he was born both Sunnite and Shi'ite, and, evinced Shi'ite as well as Ismā'īlite learnings,[2] he was at one almost a bosom friend of Maḥmūd the Ghaznavid ruler, and not on amicable terms with him, and was even thrown into prison by Maḥmūd,[3] was saved by Aḥmad ibn al-Hasan al-Maymandī the Vizier who sought for six long months to find Maḥmūd in the right mood for it, and yet could receive Mas'ūd's favour only after his antagonist, al-Maymandī, had died,[4] he returned from Jurān on the invitation of 'Ali ibn al-Ma'mūn the Khwārizmshah and also on the invitation of his successor, Abū al-'Abbās al-Ma'mūn,[5] he lived in India for 40 years as well as for only 10 years, and yet he went a number of times to India without staying there for long,[6] he began to learn Sanskrit in India and also at Kābul and possibly right in Khwārizm itself,[7] is called "al-Bayrūnī" because he was born in a place called "Bayrūn", because he did not belong to Khwārizm or its capital, because he had lived in Khwārizm for a very short period,[8] and so on We have as good authority for any one of these views as for any other the authority being that of Al-'Uṭbī (died 427 or 431 A H), Abū al-Faḍl al-Bayhaqī (Co 385—470 A H), Al-Sam'ānī (506—562 A H), Abū al-Hasan al-Bayhaqī (490—565 A H), Al-Nizāmī al-'Arūḍī (wrote between 547 and 552 A H), Yāqūt Al-Hamawī (Ca 575—626 A H), Ibn al-Athīr (555—630 A.H), Uthmān al-Jūzjānī (wrote Ca 664 A H), Ibn abī Uṣaybo'ah (591—668 A H), Ibn Sa'īd (610—685 A H), Al-Shahrazūrī (died Ca 687 A H) Al-Ghaḍanfar (630—692 A H), and Al-Qalqashandī (756—821 A H), not to mention such recent

authorities as H M Elliot, E C Sachau, Muḥammad ibn 'Abd al-Wahhāb al-Qazwīnī and S H Baranī

The earliest biographical notice of al-Bayrūnī in an extant work, so far as we know, is found in Kitāb Titimmah Ṣiwān Al-Hikma of Abū al-Hasan 'Alī al-Bayḥaqī[9] but he did not have any first-hand knowledge nor has he mentioned the writer on whose authority he had given his narration Moreover, his account is vitiated by a number of impossible statements such as that al-Bayrūnī lived in India for 40 years and that he was born at a place called Bayrūn which was an excellent and marvellous town (offering an explanation why such a place should be so wonderful by saying that after all the pearl is found in pearl-oyster) Al-Nizāmī al-'Arūḍī's account, though not a biographical notice, contains many "facts" about al-Bayrūnī which are not to be met elsewhere However, this man, who was a fable-monger pure and simple, has made so many patent misstatements that no credence at all can be attached to any of his statements Yāqūt al-Ḥamawī's is the only reliable early account that we have, for, whatever he has recorded is either a statement of a contemporary scholar or what he himself had happened to find in a book However, as we shall have occasion to state, some of the statements recorded by him cannot possibly be true[10] Ibn abī Uṣaybo'ah, Ibn Sa'īd and al-Shahrazūrī, who are contemporaries, appear to be the ultimate source for placing Bayrūn in Sind but not for the creation of Bayrūn itself which, as we have already seen, is found in the *Titimmah* of al-Bayhaqī (Abū al-Fidā' has mentioned "Al-Birūn" on the authority of Ibn Hawqal This, of course, appears to be a case of misreading Abū al-Fidā,[11] however, has also reported from al-Muhallabi and Ibn Sa'īd) But I cannot say if that also is a case of reading "Birūn" for "Nayrūn" He has quoted al-Bayrūnī's *al-Qānūn* also, (which must be a case of misreading) Shams al-Dīn Muhammad ibn Mahmūd al-Shahrazūrī, an extract from whose Kitāb Nuzhah al-Arwāḥ wa Rawḍah al-Afrāh fī Tawārīkh al-Hukamā' al-Mutaqaddimīn wa al-Muta' akhkhirīn has been reproduced by Sachau in his edition of *al-Āthār al-Bāqiyah*, has obviously copied from the *Titimmah* and *Mu'jam al-Udabī* of Yāqūt, adding only the location of Bīrūn (in Sind) and "Al-Shahīd" to "Al-Sulṭān", making a verbal alteration in one or two places, and yet he has been taken for the most important authority Al-Ghaḍanfar had undoubtedly read some of al-Bayrūnī's works, and generally, his account is reliable Al-Qalqashandi is a very late writer and most of his statements relevant to our present purposes have been given on Ibn Sa'īd's authority

We have seen that some of the accounts are altogether unacceptable while little reliance can be placed in the other accounts Fortunately, however, a number of personal anecdotes can be culled out from some of al-Bayrūnī's books available to us from which (as supplemented by the accounts of reliable historians of contemporary events) a reasonably good account can be given of al-Bayrūnī's life and works

That al-Bayrūnī was born in 362 A H appears to have been obtained from

al-Bayrūnī's *Risālah al-Fihrist*, for, no conflicting report has come to our knowledge The authority for the specific date of Thursday the 3rd of Dhū' al-Ḥijjah, however, appears to be al-Ghaḍanfar, and later writers have apparently taken it from him We now know that the ultimate authority for this date is that of al-Bayrūnī himself (see infra) There is, however, no such consensus regarding al-Bayrūnī's birth-place In fact, no less than thirteen different views can be distinguished, which we set out below, together with the names of those who have upheld them —

i That he was born at al-Jurjānīyah—J H Kramers,[13]

ii That he was born in the outskirts of al-Jurjānīyah—S Krenkow ,[14]

iii That he was born in the outskirts of Kath—Syed Hasan Baranī,[15]

iv That he was born in the outskirts of Khiva—E G Browne,[16]

v That he was born at Madīnah Khwārizm (i e , in the city, or the capital city, of Khwārizm)—Al-Ghaḍanfar,[17] and Sir H M Elliot,[18]

vi That he was born in the outskirts of Madīnah Khwārizm—Hamīd 'Askarī[19] and Idārah Taṣnīf-o-Tālīf,[20]

vii That he was born at Berūn/Bīrūn/Bayrūn, a village in the vicinity of Madīnah Khwārizm—S H Baranī,[21]

viii That he was born outside Madīnah Khwārizm—Al-Sam'ānī,[22] Yāqūt al-Hamawi,[23] and E C Sachau ,[24]

ix That he was born in some village in the province of Khwārizm—'Abd al-Salām Nadwī,[25]

x That he was born at Bayrūn/Bīrūn/Berūn, a town in Sind—Al-Shahrazūrī,[26]

xi That he is related (*mansūb*) to Bīrūn/Bayrūn/Berūn, a town in Sind—Ibn abī Uṣaybo'ah,[27] and, Ibn Sa'īd,[28]

xii That he was born at Bayrūn/Bīrūn/Berūn (a town somewhere in the world)—Abū al-Hasan al-Bayhaqī,[30] and

xiii That he is related (*mansūb*) to the Berūn quarters of al-Mansūrah in Sind

(To this list a fourteenth item can also be added, namely, that he was born outside the provinces of Khwārizm, if we take al-Sam'ānī to have meant "the province of Khwārizm" by the expression "balad Khwārizm")

It ıs a matter of great wonder, and regret, that none of these vıews ıs quıte correct, some beıng altogether figments of bıobıblıographers' ımagınatıons Maḥammad b Tāwīt al-Ṭanjah, ın the course of hıs research on al-Bayrūnī has found a statement of al-Bayrūnī hımself regardıng the place and date of hıs bırth Al-Ṭanjah found thıs statement ın al-Bayrūnī's *Maqālah fī Hıkāyah Ahl al-Hınd fī Istıkhrāj al-'Umar*, and thıs he has quoted ın hıs edıtıon of al-Bayrūnī's *Tahdīd Nihāyah al-Amākın lı-Taṣhıh Masāfāt al-Masākin* We reproduce the statement below —

”ولت مولدى قد اتفق بمدية حوارزم التى عرصهافى ناحةالشمال
٤١ ٢٠ و بعد ها عں مدينة السلام ىحو المشرق ساعة مستوية
تامة وكانت الو لادة بوم الخمس ثالث دى الححة سنة ٣٦٢ هحرى “

My bırth took place ın Madīnah Khwārızm (the cıty, or the capıtal cıty, of Khwārızm) whose latıtude ın the northern hemısphere ıs 41°20′ and whose dıstance from Madīnah al-Salām (Baghdād) ıs one complete level hour to the east, and thıs happened on Thursday the 3rd Dhū' al-Hıjjah 362 A H [32]

(It would appear that al-Ghaḍanfar was rıght ın ıdentıfyıng al-Bayrūnī's bırth-place as "Madīnah Khwārızm" But see, ınfra) al-Bayrūnī, as al-Ghaḍanfar had reported, was born ın the capıtal of Khwārızm, and no questıon of hıs havıng been born at any Bayrūn ın Sınd or Khwārızm or any vıllage ın the vıcınıty of any cıty arıses The questıon, however, ıs to whıch cıty dıd al-Bayrūnī refer when he saıd that he was born at Madīnah Khwārızm (the cıty or the capıtal cıty of Khwārızm) That thıs "Madīnah Khwārızm" was Khıva, ınspıte of ıts advocacy by Browne, ıs out of the questıon (at the relevant epoch Khīva was certaınly not the capıtal of Khwārızm[33] and hence could not have been referred to as "Madīnah Khwārızm"), and one wonders how Browne was led ınto ıdentıfyıng al-Bayrūnī's bırth-place at Khīva

The earlıest Arabo-Muslım[34] authorıty on the geography of the area concerned, Ibn Khurdādhbıh, the author of *Kıtāb al-Masālık wa al-Mamālık* (wrıtten ın 232 and revısed ın 272 A H) says that "the name of Khwārızm ıs Fīl, and ıt ıs on both the banks of Rıver Balkh",[35] whıch has been ınterpreted by De Goeje as statıng that "the name of the capıtal of Khwārızm ıs Fīl, a cıty whıch ıs formed of two parts on eıther sıde of Rıver Balkh" [35] Abū Isḥāq Ibrāhīm al-Iṣṭakhrī ın hıs *Masālık al-Mamālık* (wrıtten ın 318—321 A H) says that the capıtal of Khwārızm ıs the bıggest cıty of the provınce and ıs sıtuated on the northern bank of Oxus, and that ın the Khwārızmıan language ıt ıs called "Kath", he further says that the provınce has another bıg cıty called al-Jurjānīyah whıch ıs sıtuated on the southern bank of Oxus [37] Ibn Hawqal who, ın hıs *Kītab Ṣūrah al-'Ard* (wrıtten sometıme after 331 A H) has copıed almost verbatım from at Iṣṭakhrī on Khwārızm, calls the capıtal (whıch he calls *qasbah* ınstead of

madīnah)" Kāth Darkhāsh", and while he does not refer to al-Jurjānīyah as another *qasbah* he refers to Kāth as "Madīnah al-Kubrā" which leaves one in doubt if there were two capital cities[38] Abū 'Abd Allah Muḥammad al-Maqdisī, who has drawn heavily from his predecessors in his *Ahsan al-Taqsīm fī Ma'rifah al-Aqālim* (written in 375—387 A H), repeats Ibn Hawqal, adding only that Kāth is called Shahrastān[39] Now, if we look at the map of Khwārizm the first things we notice is that the course of Oxus (Nahr Jayhun=Āmū Daryā= Nahr Balkh) upstream is first in the south-easterly direction then some where past the city of Āmul it chages to almost west-east direction Thus it would appear that the capital of Khwārizm, which has been variously named as Fīl, Kāth, Kath Darkhāsh and Shahrastān, must have been to the north of al-Jurjānīyah Now, Yāqūt al-Hamawī, who visited the province in 616 A H says in his *Kitāb Mu'jam al-Buldān* that the capital of Khwārizm is called by its inhabitants "Kurkanj" of which "al-Jurjānīyah" is the arabicised form, that this city was called "Fīl" in olden times, getting named "al-Manṣūrah" afterwards, that city, which was situated on the eastern bank of Oxus, was inundated, and that there was a small town on the western bank of Oxus "facing" al-Manṣūrah called "Kurkanj" to which the inhabitants of al-Manṣūrah shifted[40] Yāqūt further says that al-Mansūrah was completely destroyed[41] Combining Yāqūt's account with the earlier statements, especially that of Ibn Khurdādhbih, it would begin to emerge that the capital of Khwārizm was once situated on both the banks of Oxus, the whole city being first given the name of Fīl and then al-Manṣūrah, the south-western quarter being known as "Kurkānj" and the north-eastern quarter called "Shahrastān", that the Shahrastān quarter was inundated and submerged under the waters of Oxus, whereupon only the Kurkānj quarter of the city remained, and that in course of time "al-Mansūrah" also went out of use This account would appear to be substantiated by a number of other considerations First, we know that when Ibn Sīnā, a younger contemporary of al-Bayrūnī, left Bukhara he came to Kurkānj where he met the Minister al-Suhaylī who presented Ibn Sīnā to his Amīr, 'Alī b al-Ma'mūn[42] Secondly, al-Bayrūnī at one place in his Tahdīd[43] reports an observation that he made in a village called "Bushakānaz" (بوشكانز) situated on the west bank of Oxus between al-Jurjānīyah and Madīnah Khwārizm, and at another place[44] refers to the same observation which, he says, was made in a village on the west bank of Oxus to the south of Madīnah Khwārizm (from which it would appear that Madīnah Khwārizm must have been to the north of al-Jurjānīyah) Thirdly, in the anonymous Persian book written in 372 A H (*Hudūd al-'Alam*) we have the same account of al-Jurjānīyah consisting of two parts, but here the two parts are named as "Shahr Andarūnī" (Inner city) and "Shahr Berūnī" (Outer City)[45] which would appear to both explain the *nisbah* of al-Bayrūnī and to be compatible with his statement about the place of his birth (That is, we would say that he was born in the quarter called "Shahr Berūnī", whence his *nisbah* of "al-Bayrūnī", but, as this quarter was part of the city proper, al-Bayrūnī had correctly referred to the place of his birth as "Madīnah Khwārizm") Finally, wherever the capital of Khwārizm might have been before or after the time in question, it must have been the city of

al-Jurjānīyah which was the capital of Khwārizm at the time when he wrote his *Maqālah fī Ḥikāyah Ahl al-Hind fī Ṭarīq Istikhrāj al-'Umar*[46] Even so, the problem posed by the itineraries mentioned by the geographers remains unsolved (Each of the geographers mentioned above has given a list of the principal habitations of the province and distances between them It appears from these itineraries that the then capital of Khwārizm was to the south of al-Jurjānīyah at a distance of 3 *marhalah* or days' journey)[47] To this we may add the account of Aḥmad ibn Faḍlān who visited the province in 309 A H on his way to Ṣaqālibah He says that he reached Khwārizm (i e, a city called "Khwārizm", possibly, however, the capital of the province) from Bukhārā, called on the Amīr of Khwārizm (i e the province) Muhammad ibn 'Irāq, from where he went to al-Jurjānīyah[48] He gives the distance between the two cities as 50 farsakh by boat[49] Ibn Faḍlan could not possibly have been mistaken, and we can therefore take it as established that al-Jurjānīyah was certainly not the provincial capital in 309 A H, and that there used to be considerable distance between the city which was then the capital of Khwārizm and the city then known as "al-Jurjānīyah" We further draw the conclusion that just as the capital of province-X is referred to in Arabic as "Madīnah - X", in Persian it is simply referred to as "X", dispensing with "madīnah" Both the conclusions gain weight from the fact that Abū al-Faḍl al-Bayhaqī reports al-Ma'mūn agreeing that Khuṭbah will thenceforth be read in Maḥmūd's name in all the cities of the province "except Khwārizm and Gurgānj"[50] (Persianised form of Kurkānj) As to which city "Khwārizm" and "Madīnah Khwārizm" refer, we have al-Bayrūnī's own testimony In the chart in which he has set out the co-ordinates of longitudes and latitudes of cities in his al-Qānūn, there are two relevant entries (i) "Al-Jurjānīya, one of the cities of Khwārizm", and (ii) "Kāth, another city of Khwārizm which was formerly its capital madīnah)"[51] Now, the most conclusive place of evidence for the view that al-Bayrūnī had referred to "Kāth" as "Madīnah Khwārizm" in connection with his birth-place comes from the geographical data given by al-Bayrūnī in the *Maqālah* for his birth-place, and in his al-Qānūn for Kāth The figures for Kāth are longitude 85° 0′, latitude 41° 36′ The figures for his place of birth are longitude 85° 0′, latitude 41° 20′ (There is however a slight discrepancy, viz, the latitude of one is 41° 36′ and of the other it is 41° 20′ The difference of 16′ can be explained in many ways For example that 41° 20′=ماك was really 41° 35′= 'ماله or that these were the figures accepted by al-Bayrūnī as correct at different times,[52] etc)

This, however, leaves some problems unsolved, to which we must now attend Now, "Fīl" was said by Ibn Khurdādhbih to be the name of Khwārizm, but not necessarily that of the capital of Khwārizm Thus, in the middle of the third century the province might have been known as "Fīl", possibly by the Irānians, while the name of its capital could be "Kāth" (It could also be that al-Jurjānīyah was then the capital and was known as Fīl) Ibn Faḍlān came to Kāth, which was the capital of Khwārizm in 309 A H and which he has called, as is done in Persian, just by the name the province itself was called[53] Al-Iṣṭakhrī

has placed Kāth on the northern bank (and al-Jurjānīyah on the southern bank) because the latitudinal line crossing Oxus and Kāth (or al-Jurjānīyah) would have Kath to the north (and al-Jurjānīyah to the south) of that line (Al-Iṣṭakhrī has clearly mentioned that the name of the capital was "Kāth" and that al-Jurjānīyah was a big city and the next largest to Kāth) Ibn Ḥawqal's statement that the capital of Khwārizm is beyond Oxus, and is nearer to the cities of Māwarā al-Nahr than the cities of Khurāsān, becomes self-evident By the time of *Hudūd al-'Ālam* the political situation appears to have changed Whereas of old there used to be one province of Khwārizm under the Khwārizmshah, with Kurkānj as a borough (including probably the whole Khurasānian area of Khwārizm) under a ruler subordinate to the Khwārizsmshahs, by 372 A H the Amīr of Kurkānj had made himself independent of the Khwārizmshahs Thus the one province of Khwārizm with its capital at Kāth had virtually become two provinces with Kāth and Kurkānj as the two capitals This, however, does not appear to have received the formal sanction of the Caliph as al-Maqdisī is not clear in recognizing this division But, of course, he refers to Kāth as *Qasbatuhā al-Kubrā*, and states that the name of its (i e , Khwārizm's) Khurāsānian capital (*qasbah*) is al-Jurjānīyah (i e , Kurkānj) We cannot, however, say whether he is right in saying that Kāth is called Shahrastān (There is nothing improbable about it as it may only be that Kāth was so called by the Irānians because it was a walled city) In 385 A H the then Khwārizmshah was killed and the whole territory united under the Amīr of Kurkānj who henceforth assumed the title of Khwārizmshah, but evidently, he continued to rule from Kurkānj Hence it is that when Ibn Sīnā migrated from Bukhārā he was presented to the then Khwārizmshah at Kurkānj, and hence it is that the Dār al-Imārah at al-Jurjānīyah referred to by al-Bayrūnī was in Kurkānj [54] As for what Yāqūt has said, it is obvious that it is simply a case of erroneous conjecture The data he had received was not enough to satisfy him and so he tried to bring about a compromise between the (apparently) conflicting statements, especially those he had received orally from the inhabitants of Kurkānj As for al-Bayrūnī's statement in Taḥdīd, placing Kāth to the north of Kurkānj, either it is a slip of pen or just another example of the writers of that period to look at the map sometimes upside down (We have an example in Yāqūt in the biographical sketch of al-Bayrūnī himself, where the North-Pole has been referred to as the South-Pole)[55]

A problem, however, remains unsolved—the problem which has been at the base of many erroneous conjectures Why was he called al-Bayrūnī or Berūnī? The fact is, we do not know We do know now that he was not called so because he was born at any place called Bayrūn or because he was born outside Kath proper We have also reason to believe that Khwārizm was his native-land [56] Then why was he nevertheless called al-Bayrūnī? I think the answer lies in two directions If it can be established that he was so called *before* he migrated from Khwārizm in the wake of Amīr of Kurkānj's annexation of the whole of Khwārizm, it would appear that his family must have been from outside of Khwārizm (certainly the city, and possibly the province) If, however, it is found to be a

later accretion to his name then the simplest explanation would be that people outside Khwārizm also had the practice of calling people "Berūnī" who happened to be strangers or immigrants and that as he did not desire to be referred to as al-Khwārizmī he adopted for himself the *nisbah* of "Al-Bayrūnī"

Al-Bayrūnī, therefore, was born at Kāth, then capital of Khwārizm,[57] on Thursday the 3rd of Dhū' al-Hijjah 362 A H But who were his parents and to which country or region did his family belong? To answer this question satisfactorily, it is required to determine what probative weight is to be accorded to the two poems reproduced by Yāqūt from *Kitāb Sirr al-Surūr* which contain biographical references [58] Even though in none of his works known to us has al-Bayrūnī quoted any verses written by himself—and he has profusely quoted verses written by others—it cannot at all be regarded as unlikely that the man who translated into Arabic *Qissah Wāmiq 'Adhrā*, wrote or translated a number of other stories, and among whose works is *Qāfīyah al-Alif fī Itmām Shi'r Abī Tammām*, contributed a few verses also The *qaṣīdah* in honour of Abū al-Fatḥ al-Bustī, it would at first glance appear, could have been written by none else than al-Bayrūnī On closer inspection, however, it seems more plausible that it was written by Abū al-Fatḥ al-Bustī or some other poet or the same Kunniyah in praise of al-Bayrūnī For, in the first instance, it appears odd that the writer of an encomium should for the greater part of his poem boast of his own connections with gubernatorial courts and of his popularity with scholars of the east and the west, then lament the sad plight into which he had fallen, and finally state that praise was due to so and-so who was then his only support On the contrary, if the *qaṣīdah* is for al-Bayrūnī this aesthetic infelicity is removed For now the poet speaks of the *mamdūh* throughout, at first associating himself vicariously with the *mamdūh* and submerging his own personality into that of his patron, then remembering himself and reminding himself that it was only meet that he should sing of the greatness of his master and pray for his betterment in this world and salvation in the hereafter Secondly, it appears more likely that after Maḥmūd's death al-Bustī was in need of a patron than that al-Bayrūnī needed his support Finally, some of the statements are not accurate, which in the case of al-Bustī can be regarded as poetic licence but cannot be so condoned in the case of al-Bayrūnī We do not know if al-Bayrūnī was ever associated with Abū al-Hasan 'Alī b al-Ma'mūn, nor as to what actual relationship subsisted between Maḥmūd and al-Bayrūnī But, we know from al-Bayrūnī himself that their relations became strained right in the year 408 A H and that Maḥmūd was never reconciled towards him and over thereafter treated him harshly [59] As for the other peom, it could very well be from al-Bayrūnī's pen, but it could equally well be altogether unrelated to him In conclusion, we would say that while little reliance can be placed in them nor can any views be based solely on their testimony, we may use them with caution to tentatively fill a lacuna in the biographical continuity

Reverting to the question of his parentage and mother-land, al-Bayrūnī

has himself stated that Arabic and Persian were for him foreign languages in which he did not feel quite at ease[60] The difficulties he encountered in learning Sanskrit and Indian sciences he has graphically depicted in his *Kitāb al-Hind* He does not appear to have known any other language except Khwārizmian, beyond a few words of astronomical vocabulary In the *Tahdīd*, he has described his being obliged to leave Khwārizm as "estrangement from homeland (*al-ightirāb 'an al-waṭan*) and to his return as "*reunion*" (*al-ijtimā' al-shaml*)[62] He was born, we have concluded, right in the capital of Khwārizm The obvious inference is that he was of Khwārizmian stock As to who exactly were his parents we have no direct testimony beyond the fact that his father's name was Aḥmad But we have considerable circumstantial evidence for the identification of this Aḥmad We know that Abū Naṣr al-Manṣūr, a grandson of 'Irāq b al-Manṣūr the Khwārizmshah,[63] was a noted mathematician and astronomer of his time, and in the *qaṣīdah* appears in the role of al-Bayrūnī's guardian and benefactor We also learn from *al-Āthār al-Bāqiyah* that Abū Naṣr was his teacher,[64] and from *Tahdīd* that al-Bayrūnī had made astronomical observations in *circa* 380 A H ,[65] i e , when he must have been only about 18 years of age Now, we have reason to suppose that he must have lost one of his parents, probably both, in his infancy or early childhood,[66] and, in the *qaṣīdah* we have a statement to the effect that he was nursed with al 'Irāq's milk This could, of course, be an instance of poetic licence, but it could embody historical truth as well If true, it would imply that al-Bayrūnī must have belonged to that or some equally aristocratic family, for, surely, no lady of that House could otherwise have designed to let any child feed on her I rather fancy that this Aḥmad was no less a personage than Aḥmad b Muḥammad b 'Irāq, the penultimate Khwārizmshah of that dynasty, and that Abū 'Abd Allah, the last Khwārismshah of the House of 'Irāq must therefore have been al-Bayrūnī's step brother This hypothesis gains further credence from the facts that (i) al-Bayrūnī had to go into hiding and eventually to migrate from Khwārizm *as a result of* the struggle between Abū 'Abd Allah and al-Ma'mūn the Amīr of Kurkānj,[67] for, I fail to see why a 23-year old youngman given to reading books, solving mathematical problems and making astronomical observations, even if he had been a well-wisher or supporter of the Khwārizmshah and his uncle, should have to migrate from his mother-land, (ii) al-Bayrūnī never called himself al-Khwārizmī—the reason for which would appear to be that al-Bayrūnī was afraid of being chased by the Ma'mūnids even in his exile, and (iii) that al-Bayrūnī could dare to incur Maḥmūd's displeasure in the year in which the latter had made himself the master of Khwārizm and that too right in the lion's den—at Ghaznah[68] of all places As for the verse in which his mother is stated to have been the carrier of wood, the expression has certainly been used for poetical effect, there, Abū Lahab is not his father but al-Bayrūnī himself, and, as such, his mother's having been a wood-carrier (*hammālah al-haṭab*) could have been established only if he himself would have been Abū *Lahab* It is obvious that both the expressions, "*Abū Lahab*" and "*Hammālah a Haṭab*", have been used metaphorically for "an ill-mannered old-man" (*Shaykh bi-lā abad*) and "a despicable woman".

Al-Bayrūnī must have commenced his studies very early and in all likelyhood under the supervision of Abū Naṣr al-Manṣūr' (So far as we know, Abū Naṣr is the only person who has been called by al-Bayrūnī his teacher S H Baranī has certainly committed a slip here) [69] It was probably as a result of this pupilship that he became so keenly interested in astronomy and the mathematical sciences so early in his life In his Taḥdīd he has mentioned an astronomical observation that he made in circa 380 A H [70] which means that his age was then something like 18 years and could possibly be even less By the time he had attained the age of 23 years in 385 A H, he had already conducted astronomical observations on quite a large scale and determined the latitudes of various places in Khwārizm with remarkable accuracy [71] What he did between 385 A H and 387 A H. we cannot say But, it is reasonable to conjecture that he continued to live at Kāth or some nearby place, devoting himself mainly to reading books and solving the then unsolved problems in mathematics and mathematical astronomy, possibly in the solution of the problems ever since known as "Al-Bayrūnī's problems" In the year 387 A H he made a lunar observation at Kāth in cooperation with Abū al-Wafā' al-Būzjānī, who conducted his observation at Baghdād, for the determination of the longitudinal difference between the two cities [72] (Result 15° exactly) Sometime after this observation al-Bayrūnī left Khwārizm When exactly did he reach Jurjān we cannot say, nor as to when did he receive the patronage of Qābūs b Washmgīr In *al-Āthār*, al-Bayrūnī has mentioned that he had been to Rayy before he had received Qābūs's favour,[73] and, therefore, it if was not the case that he had been to Jurjān earlier also, it would appear that he had not taken the direct route to Jurjān via Dihistān but had crossed over to Khurāsān Since he appears to have been in an impoverished condition while in Rayy, it may be inferred that some time must have elapsed between his leaving Khwārizm and reaching Rayy Late in 390 A H he started writing al-Āthār,[74] but he had already written *Kitāb Tajrīd al-Shu'ā'āt wal-Anwār* and dedicated it to Qābūs [75] It was in 388 A H that Qābūs had himself returned to his rule in Jurjān, and, therefore, it would appear that al-Bayrūnī was received by him in *circa* 389 A H It is possible that before this, he had come under the patronage of the Ispahbad of Jilān, Marzbān b Rustam,[76] (who is probably the gentleman whose daughter had been married to Iskandar, son of Qābūs), for, he had written for this notable his *Kitāb Maqālīd 'Ilm al-Hay'ah Mā Yahdath fī Basīṭ al-Kurah* [77] But he could just as well have written this book while he was with Qābūs In any case, by 390 A H he had written at least 10 books, including *Kitāb fī Isti'āb al-Wujūh al-Mumkinah fī San'ah al-Uṣṭurlāb* (which is extant in manuscript form and which may throw some light on some of these questions), and an account of the exchange of views he had with the 'young scholar' (*fatā al-fāḍil*), Ibn Sīnā, on some scientific problems During his stay in Jurjān, he made at least two astronomical observations, one in Rabī' al-Thānī 393 A H and the other in Shawwāl 393 A H,[78] and a number of attempts to measure a degree of the circumference of the earth, for which latter he used to select localities situated between Dihistān and the land of the Ghuzz Turks [79] We cannot say if he

returned to Khwārizm at the invitation of Abū al-Ḥasan 'Alī b al-Ma'mūn in 394 A H [80] and, if so, whether he continued to reside in Khwārizm thereafter, but, he did make an astronomical observation at al-Jurjānīyah in Khwārizm (then probably the capital) on the 14th of Ramaḍān 394 A H [81] It is not impossible that he may have come to observe lunar eclipse there, returning to wheresoever he had come from, but, it appears more likely to me that, as the *qaṣīdah* suggests, al-Bayrūnī had become dissatisfied with Qābūs,[82] and some powerful friends back home had made it possible for him to return and be received by 'Alī, the then Khwārizmshāh, and to be appointed to a post of some eminence (soon after his return to Khwārizm whenever did that happen—he was appointed to a post which the envious grudged him and in which capacity the wise and magnanimous were happy to see him) [83] 'Alī died in 399 A H [84] and he began serving the last of the Ma'mūnid Khwārizmshahs—participating in literary sittings, tendering advice on internal and external matters, going on at least one secret mission (to receive from the Caliph's emissary the honorific robe and Certificate of Titles on behalf of al-Ma'mūn), pacifying rebellious leaders, and keeping company at the drinking table,[85] but evidently not reading any books to, or writing for, this young prince[86]—whom he continued to serve until late in the year 406 A H when he probably resigned his post and once again returned to his scientific pursuits (From Shawwāl 406 to Rajab 407 A H we find him making several astronomical observations at al-Jurjānīyah [87] It is, however, possible that he had continued to be in government service, and that the observations were made with Abū al-'Abbās's blessings But it is altogether unfounded that he was the Vizier during al-Ma'mūn's last days) [88]

In Shawwāl 407 A H, Abū al-'Abbās al-Ma'mūn was killed by the mutineers whereupon Maḥmūd marched on to Khwārizm, crushed the rebels and, if Abū Al-Faḍl al-Bayḥaqī is to be believed, carried away practically every member of the Khwārizmian aristocracy to Ghaznah[89] in early 408 A H [90] We do not know what transpired at Ghaznah, except that sometime that year al-Bayrūnī's daring retort so annoyed Maḥmūd that he never forgave the audacious scholar Whether he was imprisoned or not I cannot say, but soon we find him at Hayfūr near Kābūl making astronomical observations (Jumādī al-Ukhrā 409 A H) [92] It was in this year (i e 409 A H) that, on his way back from the expedition to Mathura in India, Maḥmūd must have shown the jewel to al-Bayrūnī which he had seized from the temple at Mathura [93] From Rajab 410 to Shab'bān 411 A H we find him at Ghaznah, once again making a series of astronomical observations [94] In *circa* 413 A H we find him in such hardships and difficulties that he even consulted astrologers [95] (Baranī says that he wrote his *Maqālah Ifrād al-Maqāl* in 413 A H,[96] but in the published text of this maqālah there is no mention as to when was it written) In 415 A H, however, he appears to have been called upon by Maḥmūd in connection with the statement of the ambassadors "from the farthest limits of the Turks" that there was a place where the sun rotated above the earth, and to have satisfied Maḥmūd on this issue [98] It appears that he took advantage of this opportunity to add to his knowledge of places and

distances [99] In Rajab 416 A H, he finished his *Tahdīd* at Ghaznah [100] At about that time, probably earlier, he translated at Ghaznah the Sanskrit work *Karana Tilak* into Arabic [101] From these two works we learn that he had already been to India, from where he had brought the book *Karana Tilak* to Ghaznah, and where he had put into actual practice the "Dip-method" for the determination of the length of the earth's circumference In 418 A H, ambassadors came from Qitā'ī Khan[102] whom al-Bayrūnī had the occasion to interrogate and from whom he is thought to have acquired knowledge about cities in the far east [103] In Rajab that year (418 A H) he wrote his *Risālah fī Istikhrāj al Awtār fī al-Dā'irah,*[104] but at which place we do not know He wrote *Kitāb al-Tafhīm* for a Khwārizmian lady in 420 A H, probably at Ghaznah [105] In Rabi' al-Thānī 421 A H Maḥmūd died, the struggle between his two sons culminated in Mas'ūd's victory who probably arrived in Ghaznah as ruler in Jumādī al-Ukhrā 422 A H [106] This year he finished at Ghaznah his *Kitāb fī Ikhtilāf al-Wāqi' fī Taqāsīm al-Aqālīm* [107] There is reason to believe that Kitāb al-Hind was also being written at about that time, and, was finished at Ghaznah in 422-423 A H [108] exhausted by constant work and lack of due appreciation, he fell seriously ill in 423 A H and it was only by sheer determination and will power that he overcame his illness towards the end of 423 A H or sometime in 424 A H [109]

Before we continue with our narration, we shall endeavour to determine what relationship actually subsisted between al-Bayrūnī and Maḥmūd, and for how long and during which period did al-Bayrūnī reside in India As stated earlier, we do not know how did he occupy his time after his arrival in Ghaznah and before he is found making astronomical observations near Kābūl Al-Bayrūnī could have been in India during this period, but there is no evidence for that Again, between 411 and 415 A H we do not know where he was or what he was doing, except that in *circa* 413 A H he was in so unfortunate a circumstance that he was reduced to consulting astrologers I think that this is the period during which he must have been in India The astrologers whom he consulted, we know, mistook his age greatly,[110] I wonder if that was because the Indian astrologers could not guess his age correctly, his having come from a different clime and place The period is long enough for a man of genius like al-Bayrūnī to improve upon his knowledge of Sanskrit to such an extent that he could not only translate books from Sanskrit into Arabic but also from Arabic into Sanskrit Finally, in *Ghurrah al-Zijāt* his translation of *Karana Tilak*, he states that he had found that Sanskrit work of Vijaya Nanda while he was in India, and in this translation al-Bayrūnī takes 25 Ṣafar 416 A H for conversion into other eras because, as he stated, it was a famous day, the day on which Maḥmūd met Khān Yūsuf [111] It is clear that the book must have been written shortly after that event, and that al-Bayrūnī must have acquired that book sometime earlier in India From 416 A H up to the time of his serious illness we find him at Ghaznah feverishly engaged in writing books and maqālahs, and we have no evidence for his having gone to India at any time during this period After his recovery from the illness which almost killed him, he must have been too weak at the advanced age of 62 years to undertake

journey to India Moreover, in none of his extant works written after *Kitāb al-Hind* does he improve upon that justly celebrated work, rather, as Robert Schramm and Sachau have pointed out, he becomes capable of confounding two Indian eras in his *al Qānūn* which he had so clearly distinguished in his *Kitāb al-Hind* [112]

As for his beginning to learn Sanskrit, if he did not go to India right in 408 A H he must have started taking lessons in that language at Ghaznah [113] Maḥmūd had in his employ Indian soldiers who constituted a whole contingent and were officered by their own brethren [114] In fact, it would appear that there used to be a large Indian colony of settlers (not to mention the traders and casual visitors) in the metropolitan city of Ghaznah [115] As a boy, al-Bayrūnī used to go to a Roman (a Greek?) a visitor to Khwārizm, to learn the names of fruits and plants,[116] is it likely that he would not take advantage of learned Indians who could teach him their language and their sciences? Moreover, four years or so which we get between 411 and 415 A H, does not appear sufficient to enable him to do whatever his official assignment might have been and yet to start learning the ABC of the language at the beginning of this period and at the end of this period to have translated a number of books from that language and some *into* it As al-Bayrūnī has given the names of the planets and the signs of the zodiac in Sanskrit (along with six other languages) as early as his *al-Āthār*,[117] it is not impossible that he might have learned Sanskrit alphabet right in his hometown of Kāth

Regarding his relations with Maḥmūd, I think Sachau has reached the right conclusion, though on insufficient evidence, in his introduction to *Indica* Al-Bayrūnī's attitude towards Maḥmūd is a mixture of the sentiments of daring, fear, resentment and remorse Sometimes he is more daring than afraid, more resentful than remorseful, and at other times he is almost the reverse We know that his sharp retort in 408 A H won him Mahmūd's life-long displeasure, and yet we find Maḥmūd showing him the Mathura jewel in 409 A H and consulting him on an astronomical question in 415 A H Their attitudes towards each other are ambivalent Al-Bayrūnī was certainly no confidant or court astrologer of the Amīr, but he could have been in his employment, i e, in the service of the State If so, this position must have been such that he could pay for books procured from remote places in India (and possibly elsewhere) and for the services of Indian pundits (brought to Ghaznah?) who could teach him those books, but yet which neither allowed him complete freedom to devote himself to engagements of his own choosing, nor eminent enough to be commensurate with his great abilities or to be such as to make him feel happy (S K Chatterji thinks that the Sanskrit legend on some coins of Maḥmūd issued after the annexation of the Punjab must have been translated from Arabic by al-Bayrūnī He would, moreover, like to think that the decision to issue the bilingual coins had been taken on al-Bayrūnī's suggestion [118] Baranī has gone one better by asserting that it *was* on al-Bayrūnī's suggestion that the decision was taken [119] Now, it is possible that Mahmūd, or whoever happened to be the officer concerned, selected

al-Bayrūnī for the translation, but it is equally possible that an Indian scholar was chosen for the purpose. As for his having influenced the decision, this not only goes against what we know of the relationship between al-Bayrūnī and the Amīr, but also ignores the fact that Maḥmūd had decided to employ a whole contingent of Indian soldiers long before he took the decision to have bilingual coins issued for circulation in his Indian province, unless, of course, one were willing to assert that decision had also been influenced by al-Bayrūnī)

Picking up the thread of our narration, we find al-Bayrūnī badly shaken and weakened by his serious illness but as determined as ever to solve outstanding problems and to present the results obtained by him and his great predecessors in a systematic and coherent form, making things thereby much easier for future students At about this time (*circa* Shawwāl 423 A H) he had the dream he has reported in *Risālah al-Fihrist*, from which he had concluded that he yet had some 16 years to devote to his studies and writings, and from which I conclude that his instinct of self-preservation, which had remained under subjection for so long, had re-asserted itself to such an extent that the uppermost thought in his sub-conscious mind was then that of the future—a future that appeared uncertain to him at that date—and, further that, this episode must have preceded his receiving Mas'ūd's favour and financial support Aḥmad b al-Hasan al-Maymandī died in 424 A H It would therefore appear that Sachau was right in believing that al-Bayrūnī's relations with the Ghaznavid court were established only after that Vizier's death,[120] but there is just no evidence for the view that al-Maymandī was inimical to al-Bayrūnī Thus, in *circa* 425 A H al-Bayrūnī became associated with Mas'ūd's court, and, there is reason to believe that he started writing *al-Qānūn*, which he dedicated to this prince, in the year 426 A H (Jalāl Humā'ī, in his introduction to *Kitab al-Tafhīm* asserts that al-Bayrūnī started writing it in 421 A H in the last year of Maḥmūd's rule, whose courtier Humā'ī believes al-Bayrūnī to have been in 420 A H The name of the book is certainly no evidence against Humā'ī's view, but there is conclusive internal evidence to show that the book could not have been begun any earlier than 423 A H , [121] and that by the middle of 426 A H only about a sixth of the book had been written [122] J H Kramers goes even earlier and states that "the oldest extant copy of the *Qānūn* was finished in the year 416 A H " [123] Either he has referred to some other book as *Qānūn*, a slip of the pen, or someone has wrongly written "416" for, say, "516" It is known from al-Bayrūnī himself that the book had not been finished up to 427 A H) [124] In early 428 he wrote *Risālah al-Fihrist* in which, in addition to the report of some anecdotes from his life, he has given a list of his own works also We know very little about his later life, except that he finished al-Qānūn sometime between 428 and 432 A H , started writing, finished and dedicated his *Kītab al-Jamāhir fī Ma'rifah al-Jawāhir* to Mawdud b Mas'ūd[125] (ruled 432—441 A H), who appears to have continued al-Bayrūnī's grant from the treasury, to have attracted a number of devoted scholars to him who took dictation from him and thus facilitated writing of books,[126] and, that he finished his *Kītab al-Saydanah/al-Saydalah* in 442 A H at the great age of about

80 years.[127] As to when did he die we cannot really say, except that he certainly did not die on the 2nd of Rajab 440 A H , the date mentioned by al-Ghaḍanfar which, he says, he had found written in the handwriting of one of al-Bayrūnī's closest assistants, Abū al-Faḍl al-Sarakhsī, and which he found to confirm another person's report to the effect that al-Bayrūnī died at the age of 77 years 7 months [128] However, while copying from Abū al-Muḥāmid Muḥammad b Mas'ūd b Muḥammad b al-Zakī al-Ghaznawī's copy of *Kitāb al-Saydanah* in which according to al-Ghaḍanfar himself,[129] al-Ghaznawī had stated that all the (then) existing copies of *Kitāb al-Saydanah* had been derived from the rough draft the main portion of which (according to Abu Muḥāmid) had been in the handwriting of Aḥmad al-Nahsha'ī with marginal notes scribbled by al-Bayrūnī himself in a not very legible hand, al-Ghaḍanfar did not notice that according to *Kitāb al-Saydanah* al-Bayrūnī could not have died at the age of 77 years 7 months I have taken 443 A H as the most likely year because *Kitāb al-Saydanah* was finished late in 442 A H , and, because Yāqūt also appears to me to have mentioned this year (In the text we have,[130] it is actually 403 A H , but Yāqūt could not have given that date, as he himself reports seeing a book in al-Bayrūnī's own hand finished at Ghaznah in 422 A H [131] Ibn Al-Athīr has given 430 as the year of al-Bayrūnī's death,[132] which, I believe, was his conclusion from Yāqūt's text-just as 'Abd al-Salām Nadwī has done [133] These two, it appears, think that "thalāthīn" (ثلاث) is a corruption of "thalāthīn" (ثلاثين) I, however, think it more likely that "arba'īn " was inadvertently left out by some copyist, as a result of which "443" became "403"

Speaking about Firdawsī and Maḥmūd, Eduard Sachau maintains that "in the case of the King *versus* the Poet, the King has lost As long as Firdawsī retains the place of honour accorded to him in the history of the world's mental achievements, the stigma will cling to the name of Maḥmūd, that he who hoarded up perhaps more worldly treasures than were ever hoarded up, did not know how to honour a poet destined for immortality "[134] I have no desire to challenge this dictum and only wish to add that Maḥmūd certainly does not appear to have known how to honour any man destined for immortality But in the case of the King *versus* the Scientist, the scientist has lost miserably, and it is only after some nine centuries that the case is beginning to come up for revision How great has been his failure may be judged from the fact that sometime ago there was an article in one of our newspapers having a large circulation whose title was something like "Alberūnī One of the greatest scientists of all time" and whose text consisted only of a report of the astrological feat of prognosticating that Maḥmūd would go out by a door specially made in the wall for the purpose and that he himself would be thrown down that day from an elevated place but would escape unhurt Even Sachau has suggested[135] that al-Bayrūnī could have maintained himself at Ghaznah by practising as an astrologer

The earliest "authority" for this (now) well known astrological performance, so far as I know, is al-Niẓāmī al -'Arūḍī al-Samarqandī's *Chahār Maqāleh*[136]

(written between 547 and 552 A H), a prose work highly rated by E G Browne, which is also the earliest "authority" for the report that Maḥmūd had called for Abū Naṣr al-Manṣūr, Abū al-Khayr al-Khammār, al-Bayrūnī, Abū Sahl al-Masīḥī and Ibn Sīnā, the first three agreeing to go and the last two going aſway to Jurjān instead [137] In addition to the above noted astrological feat, a -Bayrūnī has been credited with another correct forecast Mas'ūd Sa'ad Salmān (died 515 A H) in his *qaṣīdah* for Sayf Al-Dawlah Abū al-Qāsim Maḥmūd, son of Sultān Raḍī al-Dīn Ibrāhīm b Mas'ūd (rule 450—492 A H), on the occasion of his being appointed governor of India, *inter alia*, states

بسال پنجه ازین پیش گفت بو ریحان   بدان کتاب که کرده است نام او تفهیم
که پادشاهی صاحقران شود بجهان   چو سال هجرت بگذشت ی و سین و سه جیم

(50 years ago, in his book called Tafhīm, Abū Raiḥān had predicted that Sayf al-Dawlah would come to rule the world in 469 A H) Now, Jalāl Humā'i states that while editing the Persian text of *Kitāb al-Tafhīm*, he looked for this prophecy in all the six old manuscripts (two of which were of the Arabic text) from cover to cover not once or twice but several times, all in vain [138] Jalāl Humā'i need not have done that al-Bayrūnī was no astrologer In fact, in *Kiāb al-Tafhīm* itself, not to mention other works, al-Bayrūnī has denounced astrology and astrologers at a number of places, as Humā'i himself has noted [139]

Reverting to *Chahār Maqāleh*, it is obvious that al-Nīzāmī was just the reverse of al-Bayrūnī, his vocation was to deceive the credulous, superstitious and vainglorious Amīrs The incident of 403 A H he has reported is altogether impossible, as even Muḥammad b 'Abd al-Wahhāb has pointed out (Among other things, al-Nizāmī makes Ibn Sīnā meet Qābūs, whereas Ibn Sīnā himself *apud* Ibn 'Ubayd has stated that he reached Jurjān only after Qābūs had been incarcerated)[140] As for the astrological feat, I believe, nothing needs to be done beyond saying that over 2000 years ago Aristotle offered an argument against astrology which has not yet been refuted Aristotle[141] pointed out that, on astrological principles, identical twins ought to lead identical lives, which was impossible

In the end, I would like to discuss how did the excellent and marvellous city of Bayrūn come into existence, how was it taken to Sind, and how was al-Bayrūnī obliged to get born there

We have seen that al-Bayrūnī's statement about the date and place of his birth is found in one of his minor and little-known works, and, it so happens that in none of his well-known or important works is he known to have repeated that statement Nor do we find any such statement in any of the known works of his contemporaries Now, it so happens that no such place as Bayrūn/Bīrūn/Berūn was known to have existed in Khwārizm, Jurjān or Khurāsān of those days It must therefore have been problematic for anyone who had either to write his biography or to write on *ansāb* Thus, the two earliest writers known to us,

Abū al-Ḥasan al-Bayhaqī and al-Sam'ānī had just that to do The first steps in the wrong direction, therefore, would appear to have been taken by these two, who happen to be contemporaries of each other If one had nothing to go upon save the *nisbah* itself, one could come to either of these two conclusions with regard to its *raison d'etre* (i) that it was derived from the proper noun 'Bayrūn' (and hence that there is a place called Bayrūn where al-Bayrūnī was born or to which his family belonged), or (ii) that it was derived from the adjectival noun "Bayrūnī", meaning "outsider" or "foreign" (and hence that al-Bayrūnī was so called because he was a foreigner to the people among whom he lived) A H al-Bayhaqī and al-Sam'ānī did just that the former (who had to give a biographical account) stated that al-Bayrūnī was born at a place called Bayrūn, but, as he had not heard of any such city, felt called upon to make that place an excellent and marvellous town, believing perhaps that just as "a pearl is found only in a pearl-oyster", so a man of al-Bayrūnī's excellence could belong only to an equally marvellous place,[142] the latter (who was writing on *nāsab* and who must have known that al-Bayrūnī's early life had been spent in the province of Khwārizm), being aware of the fact that the word "Bīrūnī" means "foreign" or "foreigner", it appears, assumed that the Khwārizmians must have been in the habit of giving this epithet to everyone who came from outside the province and did not belong to themselves, stated that al-Bayrūnī was famous by this *nisbah* and that Khwārizmians call all foreigners by that name, implying that al-Bayrūnī did not belong to the province of Khwārizm [143]

Now, in the third/fourth century Hijrah (also earlier, and possibly later as well) there used to be place in Sind somewhere between the then cities of al-Daybul and al-Manṣūrah, which has been mentioned (among others) by al-Muhallabī,[144] al-Iṣṭakhrī,[145] Ibn Hawqal,[145] and above all, by al-Bayrūnī himself [147] (In all likelihood, the name of that place was "Nirūn" or "Nayrūn Kot") [148] In Arabic the name of the city, even assuming that the writer intended it to be read as "Nirūn", can easily be read as "Bīrūn/Bayrūn", and this is what appears to have been done by some persons in the seventh century Hijrah Thus, the next step appears to have been taken (possibly among others) by Ibn abī Uṣaybo'ah[149] and Ibn Sa'īd,[150] who located Bayrūn in Sind and related al-Bayrūnī to it, without however stating it to have been his actual place of birth (Later Abū al-Fidā'[151] and al-Qalqashandi[152] did the same on the authority of Ibn Sa'īd) Finally, it was al-Shahrazūrī who, I believe, for the first time combined all these reports into its present form the fine city of excellent and marvellous things called "Bayrūn/Bīrūn" was a place in Sind where al-Bayrūnī was born and grew up [153]

Had al-Bayrūnī been in the shoes of anyone of these bio-bibliographers, he would have frankly confessed his inability to ascertain the place of birth or the reason for the *nisbah*, not so those who have written about him Surely, al-Bayrūnī *versus* Maḥmūd is a case that was decided against the scholar, and the judgement of the court of first instance (at least) as far as the people at large are concerned, has not yet been set aside

NOTES

1 I shall write "Bayrūn" for بيرون disregarding the variant readings of "Bīrūn" and "Berūn" However, if any author has given the *harakah* of "Bā'", then transliteration would be made accordingly

2 See, e g, G Sarton, INTRODUCTION TO THE HISTORY OF SCIENCE, Vol I (reprint) Washington, 1950, p 707, L Massignon, "Al-Beruni et la valeur internationale de la science arabe", AL-BĪRŪNĪ COMMEMORATION VOLUME, Calcutta, 1951, p 217, and, 'Abd al Salām Nadwī, "Alberūnī", AL-BĪRŪNĪ COMM VOL, p 254

3 See, e g, Al-Nizāmī al-'Arūdī, CHAHĀR MAQĀLEH, ed Mirza Muḥammad al-Qazwīnī, Netherlands, 1909, p 57, Muḥammad b Maḥmūd al-Naysabūrī *apud* Yāqūt al Ḥamawī, MU'JAM AL-UDABĀ, ed Saba'ī Bayrūnī, Egypt, 1937, p 183, and E C Sachau, AL-BERŪNĪ'S INDIA (Reprint), London, 1914, pp ix—xvi

4 See, e g, Al-Nizāmī al-'Arūdī, *op cit*, pp 57-58, and E C Sachau, *op cit*, p XIV

5 See, e g, S H Baranī, "Al-Bīrūnī and his Magnum Opus Al Qānūn 'al Mas ūdī" (in AL-QĀNŪN AL MAS ŪDĪ, Hyderabad, Deccan, 1956) p vi, Ḥamīd 'Askarī, NĀMWAR MUSLIM SĀ'INSDĀN, Lahore, 1962, p 460, and Muḥammad al-Qazwīnī (Notes to al-Nizāmī's) CHAHĀR MAQĀLEH, Netherlands, 1909, p 194

6 See, e g, A H al-Bayhaqī KITĀB TITIMMAH SIWAN AL ḤIKMAH, Lahore, 1351 A H, p 62, AL-Shahrazūrī (Extract in E C Sachau's introduction to AL-ĀTHĀR, p LIII), Muḥammad al Qazwīnī, *op cit*, p 195, S H Baranī (in AL-QĀNŪN), p viii, Hamīd 'Askarī, *op cit*, p 466, and, FIKR O NAẒAR, October, 1973, p 191

7 See, e g, A Learned Man *apud* Yāqūt, *op cit*, p 186, and S H Baranī (in AL-QĀNŪN) p viii

8 See, *Infra*

9 Sir H M Elliot, THE HISTORY OF INDIA AS TOLD BY ITS OWN HISTORIANS, Vol II, London, 1896, p 1, note 2, is mistaken in crediting al Shahrazūrī with being the first biographer, not only does he come after Abū al Ḥasan al Bayhaqi but also after Yāqū al Ḥamawi and Ibn abī Uṣaybo'ah See, Ismā īl Pāshā, Hadīyah al 'Arifīn, vol II, Istanbūl, 1955, p 136, and al Ziraklī al-A'lām, end ed, V p 101, IX p 157, and I p 188 Sir Henry is also incorrect in believing that al Shahrazūrī wrote "shortly after Bīrūnī's death"

10 E g, that al-Bayrūnī belonged to the countryside (MU'JAM AL UDABĀ', p 180), that Maḥmud died in 422 A H (p 180), or that Maḥmūd used to discuss with al-Bayrūnī whatever came to his mind regarding the heavens and the stars (p 183) That one 'Abd al-Ṣamad was his teacher and was executed on Maḥmūd's orders (p 186), appears to me as quite improbable

11 Abū al-Fidā' Ismā'īl b 'Alī (672—732 A H) K TAQWĪM AL-BULDĀN, ed Reinaud and De Slane, Paris, 1840 pp 348-349

12 291—352 A H (see, al-Ziraklī, AL-A'LĀM, Vol II, pp 230-231)

13 J H Kramers, "Al-Bīrūnī's Determination of Geographical Longitude by Measuring the Distances", COMM VOL , p 189

14 S Krenkow, "Berūnī and the MS Sulṭān Fātih No 3386", COMM VOL , p 196

15 S H Baranī, *op cit* , p v

16 In the Notes to his English translation of CHAHĀR MAQĀLEH, London, 1921, p 127

17 Al-Ghaḍanfar, RISALĀH AL-MUSHSHĀṬAH LI-RISĀLAH AL-FIHRIST (E C Sachau in his introduction to al-Bayrūnī Al-ĀTHĀR, reprint, Leipzig, 1923, has reproduced al-Ghaḍanfar's statement on page xvi)

18 H M Elliot, THE HISTORY OF INDIA AS TOLD BY ITS OWN HISTORIANS, Vol II, London, 1869, p 1, note 2

19 Ḥamīd 'Askarı, *op cit* p 457 (He however appears to think that there is a historical city with the name of "Khwārizm" outside of which there is or was a village called "Bayrūn/Bīrūn" where al-Bayrūnī was born)

20 ALBERŪNĪ, second edition, Lahore, 1971, pp 8—10

21 S H Baranī, ALBERŪNI, p 34

22 Al-Sam'ānī, KITĀB AL-ANSĀB, folio 98 b

23 Yāqūt al-Ḥamawī, MU'JAM AL-UDABĀ, p 180

24 (In his introduction to) AL-ĀTHĀR AL-BĀQIYAH, pp xvi—xx

25 A S Nadwī, "Alberūnī", COMM Vol p 255

26 See, AL-ĀTHĀR AL-BĀQIYAH, p LIII (Sachau has given an extract from al-Shahrazūrī's KITĀB NUZHAH AL-ARWĀḤ)

27 Ibn abī Uṣaybo'ah, 'UYŪN AL-ANBĀ FI ṬABAQĀT AL-AṬIBBĀ', Vol III, Beyrut, 1957, pp 29-30

28 Aḥmad b 'Alī al-Qalqashandī, SUBḤ AL-'ASHĀ', Vol V, pp 64-65 and Abū al-Fidā, TAQWIM AL-BULDĀN, p 348, report from Ibn Sa'īd to this effect (I have not been able to verify their statement)

30 TITIMMAH, p 62

31 October, 1973, pp 191-192 It is not explicitly stated that al-Bayrūnī was born at al-Manṣūrah in Sind It has however been suggested that Al-Manṣūrah might have spread over to the other bank of the river which might have been called "Bīrūn" and to which al-Bayrūnī's family might have belonged

32 Ankara, 1962, p v

33 Khīva was at that time a Khurāsānian town (i e a town on the west bank of Oxus) and is mentioned as such by all the geographers of the period According to al-Iṣṭakhrī, KITĀB MASĀLIK AL-MAMĀLIK, ed M Y De Goeje Leyden, 1927,

p. 302, Khīva was situated at a distance of one *marhalah* from Madīnah Khwārizm Ibn Hawqal (commenced travels in 331 A.H) states that there is a marḥalah between Madīnah Khwārizm (which he specifies as Kāth) and Khīva, see, KITĀB ṢŪRAH AL-'ARḌ, ed J H Kramers, 2nd ed , 1938, p 519 The anonymous Persian work, ḤUDŪD 'ĀLAM (written in 372 A H) ed Manochehr Satoodeh, Teherān, 1340 Yezdjerd, mentions "Khiw" and states it to have been a small borough belonging to (the principal ty) of Gurgānj (Kurkānj), see, p 123, Al-Maqdisī, AḤSAN AL-TAQĀSĪM FI MA'RIFAH AL-AQĀLIM, ed M Y De Goeje, 2nd ed , Leyden, 1906, lists "Khīva" as one of the Khurāsānian cities of Khwārizm, see, page 287

34 Some writers call everyone an "Arab" if he wrote in the Arabic language, others call everyone "Muslim" if he belonged to lands (actually in theory) governed by the Caliph or a Muslim Amir, even though the person concerned may neither be of Arab stock nor profess the religion of Islam It is suggested that "Arabo-Muslim" would be more appropriate epithet as it would also cover those who were one but not the other in addition to those who were both As for those who were neither, since they did belong to the Arabo-Muslim civilisation, the epithet may be said to apply to them in a broader sense

35 KITĀB AL-MASĀLIK WA AL-MAMĀLIK, ed M J De Geoje Leyden, 1889, p 33

36 Le nom proper de la capitale de Khwārizm est Fyl, ville qui est form'ee de deux quartiers, sur les deux rives du fleuve de Balkh" (p 24 of the translation)

37 *Op cit* , pp 299 300

38 *Op cit* , p 478, p 477 and p 477

39 *Op cit* , p 287

40 *Op cit* , Vol II, Teherān, 1965, pp 480—483

41 *Op cit* , p 483

42 Ibn Sīnā apud Abū 'Ubayd Al-Jūzjānī See, al-Qifṭī, Ta'rīkh al-Ḥukamā', ed J Lippert, Leipzig, 1903, p 417

43 Ed , al-Ṭanjah, Ankara, 1962, pp 52-53

44 TAḤDĪD, pp 80-81

45 Ed Manochehr Satoodeh, Teherān, 1340 Yezdjerd, p 123

46 Al-Ma'mūn b Muḥammad, Amīr of Kurkānj, evidently continued to rule from Kurkānj Abū 'Abd Allah, we know from al- U bī (*op cit* pp 95-96) was taken to Kurkanj where he was beheaded in the presence of al-Ma'mūn, Ibn Sīnā was presented to the then Khwārizmshah at Kurkānj, on his return from Jurjān, al Bayrūnī appears to have come to Kurkānj (whereas previously he used to reside in Kāth), where he made a series of observations in 406-407 A H including one in the Dār al-Imārah, it was at Kurkānj that a tower was built in 401 A H on Abū al-'Abbās al-Ma'mūn's orders, who is stated in the inscription recovered from its ruins to have personally visited the site; and, finally, all later writers mention this city as the capital of Khwārizm, and it appears to have continued to be so till 618 A H when the Tartars destroyed it.

Abū al-Faḍl al-Bayḥaqī in his TA'RĪKH, however, appears to regard Kāth as the capital, for he states that Abū al-'Abbās agreed to have Khuṭbah delivered in Maḥmūd's name in all the cities of his realm except "Khwārizm and Gurgānj" This, however, appears to me to indicate only that al-Bayḥaqī continued to refer to Kāth as "Khwārizm" without realizing that "Khwārizm" then applied to another city

47 See, e g , al-Iṣṭakhrī, *op cit* , pp 341-342, and Ibn Ḥawqal, *op cit* , pp 519-520

48 RISĀLAH IBN FADLĀN, ed Sāmī al-Dahān (Tr into Persian, A F Ṭabāṭabā'ī, 1325 Yezdjerd, pp 62-63)

49 *Ibid*

(The distance given by Ibn Fadlān, however, appears to be too large In TAḤDĪD, has taken the distance between Madīnah Khwārizm and al-Jurjānīyah Kurkānj in farsakhs as 19 and in miles 57, see, p 232 Even the fact that al-Bayrūnī's must have been the air distance, and Ibn Fadlān's was, as he himself states, the distance by boat, does not seem sufficient to account for the difference—the difference of 31 farsakhs or 93 Arabian miles being too great for that It is, however, possible that Ibn Fadlān may actually have stated the distance to be 50 miles, which would be short by only 7 Arabian miles)

50 TA'RĪKH BAYḤAQĪ, ed Ghanī and Fayyād, Teherān, 1324 A H pp 674-675

51 AL-QĀNŪN AL-MAS ŪDI, Hyderabad, Deccan, 1954— 1956, p 575

52 In his TAḤDĪD, al-Bīrūnī obtains by mathematical operation 41° 35′ 40″ as the latitude of Madīnah Khwārizm, which he states to be in agreement with the values earlier obtained by observation, see, p 234 For al Jurjaniyah's latitude he gives different figures, 42° 0′ 35″ (Page 49) and 42° 30′ 13″ (Page 51) obtained on the same day by different methods, 42° 10′ 3″ (Pages 51-52) by yet another method, and 42° 17′ (page 54) which he states to be the "actual" value

53 I have not been able to compare the Arabic original of the RISĀLAH However, "Khwārizm" has been used in the Persian translation for a city, the city where Ibn Fadlān called on the then Khwārizmshah

54 A F al-Bayḥaqī (Ta'rīkh Bayḥaqī, pp 675-676) narrates how the rebellion broke out and what happened thereafter In this connection he states that the rebels after killing the Vizier and other Elders, reached Dār al-Imārah where they killed the Khwārizmshāh This lends further support to the view expressed in the text

55 See, M AL-UDABĀ', p 183

56 Al Bayrūnī has described his emigration from Khwarizm as "estrangement from hom land" (al-ightirāb 'an al-waṭan) and his return thereto as "reunion" (al-ijtimā' al-Shaml), see, TAḤDĪD, p 81

57 It should be clear by now, why al-Ghadanfar was not right in stating al-Bayrūnī to have been born at Madīnah Khwārizm Al Ghadanfar (born 630 A H) wrote at a time when Kāth was no longer the capital In fact, by the time he came to write his RISALAH, even Kurkānj, the later capital, had been almost completely destroyed by the Tartars

58. M AL-UDABĀ', pp. 186—189

59 KITĀB AL-JAMĀHIR FI MA'RIFAH AL-JAWĀHIR, ed S Krenkow, Hyderabad, Deccan, 1355, A H, pp 26-27

60 S Krenkow (in the article actually given as "F Krenkow" F standing for Father perhaps), "Abu'r-Raiḥān al-Berūnī", ISLAMIC CULTURE, vol VI (1932), has reproduced a passage to this effect from al-Bayrūnī's KITĀB AL-ṢAYDANAH

See also, L Massignon, *op cit*, p 218 who in his translation is still more explicit, " , ma langue natale, Kharazmienne "

61 Ed E C Sachau, p 12

62 P 81

63 This connection has been challenged by Muḥammad al-Qazwīnī, *op cit* p 249 Here it is he who has gone wrong and, surprisingly, it is al-Niẓāmī who is right Al-Qazwīnī has simply mistaken the identity of Khwārizmshah However, it is obvious that "Mawlā Amīr al-Mu'minīn" could not be an ordinary Khwārizmian, and, hence that as his genealogy suggests, he was the grandson of ' Iraq the Khwārizmshāh I do not know what led E G Browne to go one step better than his original (al-Qazwīnī) and to pronounce the name of Abū Naṣr's grand-father as 'Arrāq

64 Ed E C Sachau (reprint), Leipzig, 1923, p 184

65 P 234

66 Any book on abnormal psychology may be consulted on the point (I am happy to note that S H Baranī had reached the same conclusion See, al-Qānūn p v)

67 TAḤDID, p 81

68 KITĀB AL-JAMĀHIR, pp 26-27

69 S H Baranī states that one Bandād al Sarakhsī (in the text actually al-Sarhasnī) was also his teacher, and quotes AL-ĀTHĀR, p 184 line 20 in support of his claim (See his ALBERŪNI, Lucknow, 1915, p 41) Baranī has obviously made a slip here as it is Abu Nasr who has been mentioned as "ustadhī" in the text quoted 'Abd al-Salām Nadwī has made the same claim and cited p 25of AL-ĀTHĀR in its support The text quoted does not support the claim as only the name of one Muḥammad b Isḥāq b Ustādh Bandād al-Sarakhsī has been mentioned by way of example (See line 15).

70 P 234

71 See, e g TAḤDID, pp 52-53, 81, 232 and 236, and, AL-QĀNŪN, p 365

72 TAḤDID, p 236

73 (I do not know from where did Baranī, AL-QĀNŪN, p v get the idea that it was Abū Naṣr who put al-Bayrūnī in touch with Abū al-Wafā' al-Būzjānī, whom he further states—possibly on the authority of Z A al-Mūsawī, who, in the introduction to his edition of RASĀ'IL ABI NAṢR MANṢŪR IBN 'IRĀQ ILĀ-AL-BAYRŪNI, Hyderabad, Deccan, 1948 states Abu Nasr to have been a pupil of Abū al-Wafā'—to

have been Abū Naṣr's teacher In any case, Baranī has made a slip in stating that the two great astronomers had observed a solar eclipse, it was actually a lunar eclipse which they 'jointly' observed)

73 P 338

74 In AL ĀTHĀR, al-Bayrūnī takes 1 12 1311 Alexandrine for conversion, see p 194 By calculation the day is found to fall in the month of Shawwāl 390 A H

75 AL-ĀTHĀR, p 10

76 Z A Azhar *op cit*, p 6, states that al-Bayrūnī remained associated with the court of Marzbān b Rustam up to 387 A H but it is not clear on whose authority he has so stated, for, he has given references for all the statements together, In any case, this goes against the fact that al-Bayrūnī made an observation in Kāth in 387 A H (unless had been to Jīlān earlier)

77 Al-Bayrūnī, RISĀLAH FIHRIST KUTUB MUḤAMMAD IBN ZAKARIYAH AL-RĀZI (in Sachau's ed of AL-ĀTHĀR)

78 AL QĀNŪN, pp 740-741

79 TAḤDĪD, p 204

80 Baranī categorically states that it was at 'Alī's invitation that al Bayrūnī returned home some time in 394 A H, see, AL QĀNŪN, p vi So far as I know, Baranī is the only writer who has fixed the date of his return to Khwārizm in 394 A H, all others (including Baranī in ALBERŪNĪ) have placed it much later, in the period between 400—403 A H However the evidence, for this view (apart from the observation mentioned in the text) there being none, it would appear to be a guess by Baranī ('Alī was probably the ruler in 394 A H, al-Bayrūnī made an observation in al Jurjānīyah in 394 A H, in all likelihood al-Jurjānīyah was then the capital of Khwārizm, al Bayrūnī is not known to have been abroad any time between 394 A H and Abū al-'Abbās's accession, whenever al-Bayrūnī may have returned to Khwārizm, soon after his return he was appointed to a high office, the qaṣīdah includes Alī's name in the list of patrons, therefore, al-Bayrūnī returned home in 394 A H at 'Alī's invitation It is, however, ignored that he may have returned at the invitation of someone else, who may have made it possible for him to be received by 'Alī and to be in due course drafted in government service)

81 AL-QĀNŪN, p 74

82 Al Bayrūnī's dissatisfaction with Qābūs is evidenced also by the fact al-Bayrūnī did not publish his AL ĀTHĀR up to 428 A H, and that in his later writings shows no warmth of feelings towards him

83 TAḤDĪD, p 81

84 Ḥamīd 'Askarī *op cit*, p 461, says that 'Alī died *circa* 1009, but no authority is cited I do not rememb r from where have I got this date However, al-Bayrūnī *apud* A F al Bayrūnī, p 667, states that he served al-Ma'mūn for seven years Assuming that he served up to the third quarter of the year 406 A H he should have started serving him in 399 A H

85 A F al-Bayhaqī, *op cit* pp 667—675

86 We do not know of any book written, by al-Bayrūnī for him In A F al-Bayhaqī there is no mention of his reading any book to him or discussing any scientific questions with him Nor is there any direct evidence for his participation in the construction of the tower built at al-Jurjānīyah in 401 A H The fact, however, that al-Bayrūnī was then in the service of Abū al-'Abbās who personally visited the site of construction, and that al-Bayrūnī had the requisite ability to be associated with the project in some capacity, lends itself easily to the view that he must have played a part into it (This view would have been considerably strengthened if al-Bayrūnī would have been in Qābūs's service at the time of the construction of Gunbad-e-Qābūs in the year 397 A H , but, we know that al-Bayrūnī was at al-Jurjānīyah in 394 A H , and we have no evidence for the view that he returned to Jurjān anytime after this sojourn to Khwārizm)

87 TAḤDĪD, pp 49, 53, 89, 101 and 118, and, AL-QĀNŪN AL-Q, pp 618, 619, 620, 622 and 661

88 "Ma'mūn appears to have appointed al-Bayrūnī his Minister"—Baranī, AL-QĀNŪN, p vi

However, A F al-Bayhaqī categorically states that the rebels killed the Vizier (of Abū al-'Abbās), TĀRIKH BAYHAQĪ, p 675 Therefore, al-Bayrūnī could not have been that Vizier We have seen that al-Bayrūnī conducted a number of astronomical observations between Shawwāl 40? and Rajab 407 A H It would, therefore, appear to be quite unlikely that he would then be the Vizier during that period Moreover, in A F al-Bayhaqī's report of the incidents leading to the killing of Abū al-'Abbās, the last time al-Bayrūnī appears in the role of an adviser is when he suggests to Abū al-'Abbās to bring about reconciliation between the Khān and Ilak who were then reportedly fighting in the area of Uzgand—which would appear to have taken place at least one year before Abū al-'Abbās's death so that the incidents occurring between the tendering of that advice and the killing of Abū-'Abbās may get time to take place In any case, A.F al Bayhaqī's account only shows him in the role of a confidant and adviser (of sufficient importance to be able to pacify the rebellious leaders) and not that of a Vizier (with administrative powers)

89 TA'RĪKH BAYHAQĪ, p 676 ff

This need not surprise us Maḥmūd did not come to Khwārizm to teach a lesson to the rebels or to avenge the murder of his sister's husband, Abū al Abbās, but to annex the province to his expanding realm In any case, it is apparent that a great majority of the nobles of the province were opposed to the idea of making Maḥmūd their over-lord, and that after Abū al-'Abbās's death, a Ma'mūnid prince (son of 'Alī or al-Ma'mūn) was proclaimed Khwārizmshāh, therefore, whether a given noble had sided with or opposed abū al-'Abbās, Maḥmūd could not rely upon his loyalty to him (It may also be mentioned that Maḥmūd did not wholly rely upon even Abū al-'Abbās; in fact, when peace was made between the Khān and Ilak through the good offices of his ambassadors, Maḥmūd became suspicious of his motive for that endeavour)

90 The air had become warm when (according to A F al-Bayhaqī) when Maḥmūd marched towards Khwārizm, see, TA'RĪKH, pp 677-678 According to 'Abd al-Wahhāb al-Qazwīnī (HAWĀSHĪ) CHAHĀR MAQĀLEH, p 195, it was spring time when Muḥmūd left Khwārizm for Ghaznah The year mentioned in both the reports is 408 A H It would, therefore, appear that it must have been in early 408 A H that Maḥmūd returned to Ghaznah

91 S H Baranī (e g, in COM VOL, p 34) thinks that al-Bayrūnī was probably a political detenue when he applied the "Dip-method" for the determination of Earth's circumference at Nandana, believing this to have occurred in 408-409 A H As I believe him to have been to India not earlier than 411 A H the question of his having been a detenue in the fort of Nandana does not seem to arise However, al-Nizāmī may not be wrong in reporting al-Bayrūnī's imprisonment, though he is certainly wrong in giving the reason therefor, and the gap that we have in our narration (=408-409 A H) might very well prove to have been occasioned by his detention If the time and place of writing AL-KITĀB FI AL-UṢṬURLĀB (an extract from which has been reproduced by Barani, COM VOL, p Nallino's 'ILM AL-AFLĀK) could be established, this question could receive a definitive answer (This book—it appears from the extract al-Bayrūnī wrote before he had been able to put into actual practice the "Dip-method" which he had by then worked out following a suggestion of an earlier writer, al Nayrizī) Incidentally, the title of this book (unless it is identical with KITĀB FI ISTI'MĀL AL-UṢṬURLĀB AL KURRIY) has not been listed in R AL-FIHRIST

92 TAḤDĪD, p 88 (Baranī, AL-QĀNŪN, p vii, says that we find him in the vicinities of Kābūl and Qandhār I do not know from where has he got the reference for Qandahār Taking Ghaznah as the point of reference, we have Kābūl and Qandahār in almost opposite directions, and, as such, it cannot be Hayfur to which Baranī referred)

93 K AL-JAMĀHIR, p 78

94 TAḤDĪD, pp 248 and 281, and AL-QĀNŪN, pp 365, 408 and 647

95 Al-Bayrūnī, RISĀLAH AL FIHRIST (See AL-ĀTHĀR, ed Sachau, p XXXXVI)

96 AL-QĀNŪN, p vii

97 MAQĀLAH IFRĀD AL-MAQĀL FI AMR AL-ZALĀL, Hyderabad, Deccan, 1948

98 Yāqūt, M AL-UDABĀ', XVII, p 183, A F al-Bayhaqī, *op cit* p 63, and, V Minorsky, "On some of Bīrūnī's Informants", COMM VOL, p 235

99 Minorsky, COMM VOL, pp 235-236

100 TAḤDĪD, p 281

101 The Arabic translation by al Bayrūnī Ghurrah al Zījāt, has fortunately been traced The Arabic text has been edited by S S H Rizvi, who has also translated it into English The text and the English translation were serialized in ISLAMIC CULTURE beginning with Volume XXXVII (1963)

102 V Minorsky (COMM VOL, P 234) identifies the King on whose behalf this embassy came as Emperor Sheng Tsung (983—1031 A D) of the Liao dynasty

103 K AL-JAMĀHIR, p 208, and, Minorsky, COMM VOL pp 233-234

104 *Op cit*, Hyderabad, Deccan, 1948, p 226.

105 K AL-TAFHIM FI SINĀ'AH AL-TANJIM, Ed Jalāl Humā'i, 1939 The learned editor points out that the statements made on pp 135-138, 280—281 and 427 are found by calculation to imply that the book was written at Ghaznah in 420 A H, the year which al-Bayrūnī has himself mentioned in the book

106 Ibn al-Athīr, TA'RIKH AL-KĀMIL, Vol IX, pp 149 and 150 (See, however, KITĀB AL-HIND, p 203 and AL-QĀNŪN, p 688-689, which appears to be irreconcilable with the dates given by Ibn al-Athīr I hope to take up this question in a later work)

107 Yāqūt states that Maḥmūd died in 422 A H but that al-Bayrūnī was then alive and living in Ghaznah, for, he further states, he had himself seen in al-Bayrūnī's own hand his KITĀB TAQĀSIM AL-AQĀLIM written that year (MU JAM AL-UDABĀ', p 180)

Thus, the book in question was written at Ghaznah in 422 A H In the text, the title quoted is from RISĀLAH AL-FIHRIST, which appears to have been the full title of the book mentioned by Yāqūt

108 On p 203, it is stated that Maḥmūd died full ten Persian months before the Nawroz of 400 Yezdjerd, on p 252, it is said that the image (at Somnath) was destroyed in 416 A H, and, on p 206 that he found the Indians computing the year of the destruction of Somnath as 947 Sakakala

109 R AL-FIHRIST in AL-ĀTHĀR, ed Sachau, p XXXXVI
(He fell ill, as he says, after the age of 60 years, i e, after 3 12 422 A H The illness was very serious and must have kept him in bed for quite sometime He dreamt about sighting the moon at about the age of 61 years, i e, *circa* 3 12 423 A H If he finished K AL-HIND in 423, he must have fallen ill soon thereafter)

110 RISĀLAH AL-FIHRIST (See, AL-ĀTHĀR, ed Sachau, XXXXVI)

111 See, ISLAMIC CULTURE, Vol XXXVII (1963), p 185

112 AL-BERŪNI'S INDIA, pp xvi-xvii

113 S K Chatterji too is of the opinion that al-Bayrunī started taking lessons in Sanskrit at Ghaznah, while, he thinks, he was under detention See, "AL-Birūnī and Sanskrit", COMM VOL, p 86

114 See, C E Bosworth, THE GHAZNAVIDS 994, 1040, Edinburgh, 1963, p 110 (Bosworth quotes as his authority Gardizi, ZAYN AL-AKHBĀR, p 96, TĀ RIKH BAYHAQĪ, pp 237, 251-252 and 497, and Nāz m, SULṬĀN MAḤMŪD, p 140 note 7 I have, however, not checked the references)

115 That the Indian soldiers had their own quarter in Ghaznah is obvious, it is also clear that they must have been destined to remain away from their Indian homes because of their brethren's superstitious belief that they had become *malich* or impure We know from KITĀB AL-HIND itself about the Hindu rulers of Kābūl, therefore, there must have been quite a large number of Afghan Hindus, some of whom must naturally have been settled in the then capital, Ghaznah (See also S K Chatterji, *op cit*, p 86)

116 Krenkow, ISL CUL, p 531 quotes a passage from K AL-ṢAYDANAH to this effect

117 Pp 192-193.

118 "Al-Bīrūnī and Sanskrit", COMM VOL, p 98

119 Al-QĀNŪN, p ix

120 ALBERŪNI's INDIA, p ix

121 Al-Bayrūnī was on page 175 in the year 426 A H (see below Note 122) On page 168 he has given the name of Caliph al-Qā'im Bi-Amr Allah as then on the caliphal throne Al-Qā'im came on the throne on the 11th of Dhū' al-Ḥijjah 422 A H Unless therefore al-Bayrūnī wrote all those 168 pages in Dhū' al-Hijjah's remaining days, or inserted the reference to al-Qā'im at a later date, he could not have begun writing the book in 422 A H The subject-matter dealt with therein, however, is not new—some of it may be found in as early a work as al-Athār itself

122 On p 175, the day is stated to be the 5th day of the 6th month of the 9th year of the then running century of the Indians, which is found by calculation as falling in the year 426 A H

123 *Op cit*, p 190

124 In R AL-FIHRIST it is shown as unfinished (428 A.H), Masūd died in 432 A H, during whose lifetime it appears to have been finished

125 K AL-JAMĀHIR, p 31

126 We have report of at least one case in which the main text of the book (KITĀB AL-ṢAYDALAH) was in the hand of a pupil (Aḥmad al-Nashā'i) with marginal notes scribbled by al-Bayrūnī himself (Krenkow reports from al Ghadanfar, who reports from Abū Muḥāmid al Ghaznawī, see, ISLAMIC CULTURE, Vol VI, 1932, p 532)

127 I believe al-Bayrūnī has himself stated in the introduction to his KITĀB AL-ṢAYDANAH that he was then 50 years of age

128 Quoted in Sachau's introduction to AL-ĀTHĀR, p XXXVI

129 Krenkow, ISL CUL, p 532, has reproduced the statement from K AL-ṢAYDANAH

130 M AL-UDABĀ', p 186

131 *Ibid*, p 180

132 AL-LUBĀB FI TAHDHIB AL-ANṢĀB, ed Muṣṭafa 'Abd al-Wāḥid, Egypt, 1971, p 224

133 'Abd al-Salām Nadwī, "Alberūnī", COMM VOL, p 256

134 ALBERŪNI'S INDIA, p viii

135 *Ibid*, pp ix-x

136 See, p 57 Al-Nizāmī, however, says that the report has reached him "آورده اند كه" He, of course, mentions no book or writer as his source

137. See, pp. 76—80.

138 KITĀB AL-TAFHĪM, p XIV

139 *Ibid*, p xiv Jalāl Ḥumā'ī refers to K AL-TAFHĪM'S pages 316, 400 and 538 Ḥumā'ī also mentions in this connection al-Bayrunī's KITĀB AL-TANBIH ALĀ ṢINĀ'AH AL-TAMAWIYAH and AL-ĀTHĀR

140. See, al-Qifṭī, *op cit*, p 417

S H Baranī, however, has challenged this view, "I do not believe in the view held by some scholars that Ibn Sīnā never met Qābūs On the other hand we have the positive testimony of Ibn Sīnā's disciple Jūzjānī that he met the former in Jurjān in about A H 402 (i e before Qābūs' death) and found him in that King's service" (Baranī, Ibn Sīnā and Alberūnī", included in AVICENNA COMMEMORATION VOLUME, Calcutta, 1956, p 4) Baranī has referred to al-Jūzjānī's statement in the latter's preface to Ibn Sīnā's KITĀB AL-SHIFA'

Now, the relevant statement occurs on pp 1-2 of the published text of the book quoted (Vol I Isagogee, Cairo, 1952) But in his statement al Jūzjānī has not mentioned the name of Qābūs He, however, states that Ibn Sīnā was about 32 years of age when he met him at Jurjān, and that Ibn Sīnā was then in the service of 'al-Sulṭān" From this Baranī is not unjustified in reaching his conclusion, for, the year in question would appear to be 402 A H (Ibn Sīnā is stated to have been born in 370 A H) However, as only "al-Sulṭān" has been mentioned, it is quite possible that here al-Jūzjānī is referring to Qābūs' son who had succeeded him, if the year in question was 403 A H — which it could be, seeing that Ibn Sīnā could very well be "about 32" also in 403 A H even assuming that al Jūzjānī was being very exact in his statement In any case, al-Niẓāmī's statement remains quite improvable, for, Abū Ubayd only mentions Alī and not Abū al-'Abbās, and, therefore, Ibn Sīnā may be taken as having left Khwārizm as early as 399 A H —four years before 403 A H

141 I do not remember where However, I hope I am not mistaken in attributing this argument to Aristotle

142 *Op cit*, p 63

143 *Op cit* fol 98b

(We have here assumed "balad" to have been used by al-Sam'ānī in the sense of district/province and not that of a town It is, however, quite, possible that— as we had earlier assumed- he had used" balad" as a synonym for "madīnah" meaning "town" or "capital" If so, his statement would amount only to the assertion that al-Bayrūnī did not belong to the city, or the capital, of Khwārizm- Kāth While the language used allows of either interpretation, I think that "balad" should here be taken in the sense of a district/province, because it does not appear probable that the inhabitants of a town would regard every person from outside that town as a foreigner However, if this was not actually the practice, but only al-Sam ānī's guess, then it is difficult to decide what his guess might actually have been--for we do not know what exactly were the factual data he had to go upon)

144 See, Abū al-Fidā', TAQWĪM AL-BULDĀN, p 349

145 *Op cit*, pp 182 and 185 (De Goeje's reading is "البيرون" with Bā')

146 *Op cit*, p 323 (Ibn Hawqal has copied here also from al-Iṣṭakhrī verbatim, unless, of course, both have copies from a common source J H Kramers' reading, however, is "السرون" with "Nun" Facsimile of a map of Sind from Ibn Ḥawqal's book is found in Sir H M Elliot *op cit*, Vol I, facing page 32 In this map, here is a place between al-Manṣūrah and al-Daybul whose name is given as "السرون" which can be read both with B and N However, Baranī, ALBERUNI, pp 34-35 reports that there is an old MS of KITĀB ṢŪRAH AL-'ARḌ in Lucknow in which there is, he further states, a map showing the location of Nirūn I wonder if Baranī has read it as Nirun or the discritical marks are also found, the location, of course, must have been marked in any case)

147 AL-QĀNŪN AL-MAS'ŪDĪ, p 552

148 See, H M Elliot, *op cit*, Vol I, pp 396—401

149 'UYŪN AL-ANBĀ' FI ṬABAQĀT AL-AṬIBBĀ', Vol III, Bayrut, 1957, pp 29-30

150 See *supra*, Note 28

151 Abū al-Fidā', *op cit*, p 349

152 Op cit, p 64

153 See extract from his NUZHAH AL-ARWĀḤ in E C Sachau's introduction to AL-ĀTHĀR AL-BĀQIYAH, p LIII

THE POLITICAL SITUATION OF IRAN AT AL-BĪRŪNĪ'S LIFETIME

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WHEN al-Bīrūnī was born, in 973, Persian civilisation was in full efflorescence In the same year 973, Cairo was definitively founded as capital of the Fāṭimids, in far away Egypt, but when al-Bīrūnī died, about 1050, this was a fact of real importance for Iran too Thus, the political situation of his nation changed in a remarkable manner during his lifetime His work depends to a large extent on this change Consequently, a consideration of this evolution may be important for the understanding of al-Bīrūnī's scientific career

The outskirts—bīrūn—of Kāth, capital of the old independent principality of Khwārizm, was situated on the border of the Iranian living area It did not belong to one of the important states on the Iranian plateau, but had a very ancient Iranian cultural tradition under a dynasty called Afrighids which possessed this country to the south of Lake Aral for centuries Khwārizm had kept until then a special Iranian language, the Khwārizmian, known today comparatively well, but under the influence of the uprising Iranian civilisation and the spread of Islam, the Persian language was known there too

To the south of Khwārizm, on the Iranian plateau, there were two large states which had divided this territory between themselves The Samanids and the Buwayhids, Shī'ite overlords of the Caliphate to whom belonged some provinces in south-western Iran I do not wish to enumerate other minor principalities, for instance near Caucasia or on the slopes of the Zagros mountains along the 'Irāqī frontier, and I shall not describe the interior development of the Buwayhid state which was of no importance for al-Bīrūnī's life in a lecture restricted to twenty minutes approximately

The Samanid state, however, which comprised Khurāsān, Transoxiana and for some time also encompassed Sīstān and Kirmān together with Jurjān, Ṭabaristān, and Rayy, had great historical importance in several respects The linking of Eastern Persia with the borderland of Turkistān for this time protected

the Iranian inhabited region from inroads by Turks At the same time, these latter were exposed as well as the Khwārizmians to the parallel influences of the Islamic religion and Persian culture, both of which prepared the ground for the incorporation of the mass of the Central Asian Turks into the body of Near Eastern Muslim civilisation, and that civilisation as yet unshaken by outside pressure, was reaching the perfection during the period These achievements of the Samanid state would have been impossible had it not formed the centre of Persian renascence

North-eastern Iran had become the mass gathering place of the country's national and cultural forces, and these received generous encouragement from the Samanid house Another reason was the fact, that in Eastern Iran, the social structure had undergone little or no modification The leading position of the local nobility (the *dihq īns*) had been preserved, and in this milieu the national traditions, which they had carefully cherished, had remained very much alive, particularly in art and the legends of the kings This state of affairs was not disturbed by the Samanids, who had firm support in the existing social order They gave the provinces of Iran a new era of peace and security, and made it possible for the Persian intellect to regain full consciousness and develop and express itself in freedom At their court lived the first poets in the modern form of the Persian language There were composed geographical works which did much to promote the rise of geography and to give a definite shape to this branch of learning For scientific, as well as theological and philosophical works, such as those of the physician-scientist Ibn Sīnā (Avicenna, 980—1037 A C), the language in use long remained Arabic—as well as for his contemporary, al-Bīrūnī, who wrote in the same language, the only one then understood in the whole of Islamic world

The service rendered by the Samanids in promoting the science and Persian poetry was imperishable At the bottom of it lay a stable economy and a sedulous attention to agriculture, which in view of the need for very careful maintenance of the irrigation system was particularly liable to disaster in the event of unrest Samanid policy, however great its merits, was necessarily limited by this fact Yet before al-Bīrūnī's birth, internal difficulties arose The nobility (*dihq ns*) became more and more unruly, and the increasingly numerous and influential Turkish officer-clan sometimes conspired with the militant elements within the state, and sometimes joined hand with the Qarlūqs, a powerful Turkish people who for more than a hundred years was pressing in from the East The dynasty of the Qara-Khānids or the Ilak Khāns had gained ascendancy over them To these difficulties of the Samanids, were added conflicts between members of the family The reigns of Manṣūr-I (961—76) and Nūḥ II (976—97) were mainly occupied with much struggle and with others against disaffected clans of noble men In any case they had to restrain themselves to their own possessions, and to defend them against their neighbours An expansion of their power, e g in the direction of Khwārizm, was not possible, consequently,

al-Bīrūnī's homeland had the opportunity of continuing its own life of independence, so that al-Bīrūnī, politically seen, had a quiet youth

When no longer able to see any other means of warding off the growing dangers, the Samanid ruler called to his aid the Sulṭān Subuktigīn and his son Maḥmūd, Turkish slave-soldier by origin, who had risen to power in the second half of the tenth century in the governorship of the present-day Afghan territory on the Indian frontier, with the seat at Ghaznah The Samanids received help from this quarter, but their helpers were not content to leave it at that They demanded and obtained various provinces from the Samanids, and finally dislodged them - in combination with the Qara-Khānids - in 999 A year before, the last Samanid ruler, Manṣūr II (997—99) had perhaps been visited by al-Bīrūnī on his travel to Jurjān on the south-east corner of the Caspian Sea, where he lived for approximately 10 years under the protection of the Ziyarid, Qābūs, who had just regained his territory from the Buwayhids

After the fall of the Samanids, their territories south of the Oxus were incorporated in the new realm of Ghaznah while Transoxiana was added to the Qarlūq sphere of influence The destruction of the Samanid state was not such a severe blow to the renascent Persian civilisation as might have been feared It has already been pointed out that the Samanid regime contributed much to the dissemination of the Iranian intellectual patrimony and the Muslim religion among the Turks In the cultural field, the dynasty of the Ghaznavids largely carried on the task bequeathed by the Samanids In the religious fields, they proved to be zealous champions of the Sunnite orthodoxy All the Turks of this period continued to be Sunnites and spurned the never very important Shī'ite movements which, on rare occasions, were so active in their midst In this respect, they contrasted with the Persians from whom they acquired their culture

Partly as a result of their rigid orthodoxy, the Turks did not much appreciate the ancient pre-Islamic traditions of these Persians No surprise need therefore be caused by the famous story of the niggardly recompense which Maḥmūd of Ghaznah, Subuktgīn's successor in 997, and an outstandingly gifted and energetic military and political leader, thought fit to grant to the foremost poet of Iran It was under Maḥmūd's patronage that the Persian national epic took shape in the *Shāhnāmah* For every verse of this book, according to the story, Maḥmūd had promised Firdawsī (ca 934—ca 1020) one gold piece But after the accomplishment, he paid him only silver pieces (dirhams) for some reason or the other But he did not waste this money for himself, it was dissemination of Islam which was financed by it Maḥmūd turned his main attention to campaigns in the Panjab Islam had penetrated into that country as long ago, as 711, but had so far made no significant advances It first gained ground as a result of Maḥmūd's almost annual campaigns in the Panjab Besides that province and Multan, parts of Gujrat passed under the Ghaznavid rule At the city of Lahore (Lahawar), the dynasty maintained itself for a hundred and fifty years

But Maḥmūd did not restrict himself to the Panjab He undertook some campaigns in Transoxiana, he conquered certain Buwayhid districts in central Persia, in 1028, during which a Buwayhid prince was taken captive Even before that, in 1016, he undertook a campaign against Khwārizm He conquered the country after the assassination of its prince, the Khwārizmshāh al-Ma'mūn II, by his own subjects After the victory, he took a lot of prisoners, among them famous scholars, to Ghaznah One of them was al-Bīrūnī who was taken to Ghaznah in spring 1017, and who had there an opportunity of participating in Maḥmūd's campaigns in the Panjab Thus he learnt Sanskrit and some Indian languages and was able to write one of his most outstanding work, his description of India, the scientific value of which is well known to all of us Al-Bīrūnī remained at the court of the Ghaznavids until the end of his life, about 1051, highly esteemed and fostered by the rulers and thus eye-witness of their political vicissitudes for some decades

After Maḥmūd's death in 1030, one of his sons, Mas'ūd, after overthrowing a brother whom their father had designated to be successor, ruled officially till murdered in 1041 During his reign, however, fighting broke out with a family of chieftains leading the Oguz/Ghuzz Turkish/Turkman tribes Around 970, they had made their way from the modern Kazākhistān to Bukhārā These were the Seljūqs, scions of a Turkish chieftain of that name The main founders of their might were the brothers Tughril Bey Muḥammad and Cagry Bey Dā'ūd who apportioned the realm among the princes of the house in accordance with the same feudal and hierarchical principles which were customary among their Turkish tribes In a decisive battle at Dandanāqān in 1040 the two brothers wrested Khurāsān from the Ghaznavid Mas'ūd, and soon expelled his descendents who were much weakened by family strife, beyond the bounds of Persia, confining them to what is now Afghanistan, and to the Panjab They also, in a series of swiftly following victories, occupied Central and Western Persia, drove out the Buwayhids who till then had kept control of that area against the Ghaznavids, and fixed themselves at Isfahān

But the Ghaznavids and the Buwayhids were only their external adversaries Under the cover of these Sunnites, respectively twelve-shī'ite Dynasties, the Fāṭimid propaganda had succeeded in winning quite a number of Iranians, members of the leading class included, to an extreme form of the Shī'ah, the Ismā'īliyah They were the most active religious group, and their spiritual leader in Iran, Nāṣir Khusraw, is well known One has got the impression by reading the historical sources of this period, that the Ismā'īlīs were about to win the superiority in Iran, when the Seljūqs came and established the Sunnite form of Islam again even if this task took centuries After long decades, the Ismā'īlīs and their offspring, the Assassins (then mostly called Bāṭinīs) were restrained, and the last remnants of them were annihilated not earlier than by the Mongols, long after the fall of the Seljūqs in Iran

All these events happened long after al-Bīrūnī's death, who, however, was witness to the defeat of the Ghaznavids and the advance of the Seljūqs in Persia When he died, approx in 1051, the Seljūqs had penetrated Caucasia, and four years after his death, they entered Baghdad, liberating the caliphs of the Shī'ite predominance of the Buwayhids, establishing preponderance of the Sunnah and starting a new era in Iranian Islamic history Al-Bīrūnī's glory remained, however, in this new epoch and ever since until the present day

HINDU SOCIETY AT THE TIME OF AL-BĪRŪNĪ*

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CULTURE, according to the author, began with human existence, and its progress marks the stages of developments of different societies with the growth of population of each people and their dispersal across the globe, different racial groups evolved newer cultures and languages of expression At present even though there are not more than ten major civilizations, their intermingled offshoots may number hundreds

It is still a subject of discussion of among scholars, as to which civilization is the oldest Hindu civilization has a claim to be one, with its relics indicating its history many hundreds of years before the birth of Christ A study of this civilization is thus of great interest for study to throw light on its predecessors Al-Bīrūnī had the same lust for knowledge when he underlook such a study There were some books written on Hindu medicine during the Abbasid period by "Man Ka and Saleh" *Siddhanta*, the book on Hindu astronomy was also translated as early as 162 H , other books were on Hindu astrology, interpretation of dreams, foretelling, agriculture, and music In earlier periods, a Greek ambassador had visited India in 395 B C , aiming to persuade the Indian rulers to adopt land route instead of sea route for their trade He stayed in India and learned about their culture and civilization to a fair extent His writings also existed at al-Bīrūnī's time Then there were the two Chinese travellers who visited India between 5th and 7th century A D and wrote their travel diaries But they made no mention of the Indian academic institutions and universities, nor about the Taxila University Al-Bīrūnī was not satisfied with these accounts and his great urge to learn for himself brought him to India in search of new knowledge He had a scientific bent of mind for comparative studies and this made him bring in the Greek and Persian element for comparison He overcame the main obstruction of language by learning Sanskrit for deeper and more substantive studies than any of his predecessors As De Boer remarks, al-Bīrūnī regarded philosophy an inseparable constituent of cultural and civilized values, and he made adept use of it to open the path of his investigative understanding He made a comprehensive study of Indian religions, castes and customs, and has perpetuated a

*(Original article is in Urdu)

factual picture of practices followed by each caste from the birth of child onwards, and the distinct high status which the Brahmin enjoyed in the Hindu society The life of a Brahmin is divided into four sections after he attains seven years age, thereafter, between 8th and 24th year his first part of life consists of learning, travel, ritual sacrifices, and submissive service to his teachers and masters The second part involves using his attainments to teach other Brahmins and Khatris, and any income earned may be spent for a living assuming it not as earning but monetary gratitude He could approach kings and the aristocracy for monetary benefits, and could also eat fruits picked from trees or from the ground underneath He could trade only in textiles and betel nuts, and is not subject to any tax This part of his life is from 25th year to 50th year The third part of his life is from 50 years to 75 years During this period he should leave his home, family and kin and go to the seclusion of forests ensuring that he has no roof above him He is to cover his body with leaves, and sleep on bare ground, eat only vegetable leaves and items made from them, grow hair and nails without cutting them, and not use it for his hair The last part of his life is from 75 years till his end He is to meditate, free his mind from friendly or inimical feelings, from anger and desire, not to stay for more than a day in a village or five days in a city during transit, and engross himself wholly in search of nirvana, the eternal life Every Brahmin whether young or old has to give ritual sacrifices, and look after the fires, bathe three times a day to maintain the feeling of cleanliness for religious devotion, eat pot herbs daily, and use his own container for drinking water If any one else uses his water container he should break it He is prohibited to eat onion, garlic, gourd, krinclin (like radish), and nali (a vegetable growing near ponds and lakes)

This is only a brief description given here, of al-Bīrūnī's account of Brahmin customs but it clearly points to the broad plane of learning he acquired about their customs He has given accounts of Khatri, Vaish, and Shudras also with the same scholarly perfection

There is no concept of divorce in the Hindu society Even after death of her husband, she can either remain a widow for the whole life or become a *Sati*, i e burn herself on the funeral pyre of her husband During menstruation a woman is considered dirty, and could not touch any vessel or cook food She is like a Shudra during the period, and should not come near any one

According to Bīrūnī, Hindu progeny takes name after the mother and not father Therefore if the wife is Khatri or Vaish the offspring would not be Brahmin but Khatris and Vaish Two goats are sacrificed at pregnancy, and a third one at the time of delivery Hair cut of the child is done in his third year and his ear bored in the seventh or eight year

In various periods of Indian history different treatment has been presented for dead bodies In the early periods their bodies were entrusted to heavens, and

their bodies left in the open The ailing were dumped on the mountains or in the forests Then in later periods their bodies were entrusted to winds, and people built blocks with air inlets to get air to their bodies like in case of Majusis tombs This practice continued for a long time till Narain entrusted the dead body to fire Since then the dead bodies are burnt in a pyre, and there is neither any rolling of the body, nor any vestiges left to tease the memory After burning, one particular point of each body returns to heaven There points are, the spirits souls, some of which return back with sun's rays and some remain behind with the sun's fires The kith and kin of the dead are to bathe the dead body, wrap it in funeral cloth, apply perfumes, and burn it in sandal and other wood Then a part of the bone ash is to be thrown in the holy river Ganges, while the rest of the ash could be thrown in any river A symbol grave could be made at the site of burning, and whitewashed Ash throwing in rivers was re-interpreted by Gautam Buddha and the dead bodies were dumped in flowing water under this creed's practices This practice was then adopted by Veshas and Shudras to get rid of their earthly life in times of trial and raise themselves to higher attainments by throwing themselves in rivers to drown Mourning over the dead was also a Hindu custom when Bīrūnī wrote his book If the heir was a son, he was to mourn over his father's death for a whole year, refrain from co-habitation with wife, and restrain himself completely from eating in the early days of mourning He is also to provide 16 feasts, the first and second on the 11th and 15th day, and one every month during the year Then the 15th feast one day before the close of the year, which was to be for the dead and his father and forefathers etc, and the 16th after the year's close Ritual sacrifices were also performed during these feasts It was also important to make a block projection over the front door for the soul to take rest on when it was disturbed by hunger or thirst and visited the house

On inheritance, the daughter is the only female to have title, while all other females of the family are discounted Her share was 1/4th that of the son On her marriage, expenses could be drawn from her share, and after marriage her allowances would be cut In case of her husband's death she gained title to allowances from her share till her life's end Sons and nephews of the dead had preference to inherit than father of the dead or father of the dead wife In case of absence of sons and nephews, the old brother of the dead had preference In case of many persons having an equal claim to inheritance, the property was to be divided equally Any debts left by the dead were payable by the heir or inheritors, even if no property or money was left behind by the dead

Idol worship formed an inseparable part of the Hindu society, and way of life, and exhibited on occasions of celebrations, feasts, mela gatherings, and days of devotional observance Idols were presented with food, devotional prostrations, and ritual sacrifices

There was also a system of justice which though not so organised but had

the elements on which a structure of jurisprudence could be constructed Thus the judge asked for a written complaint from the complainant and the complainant was to file the written suit accompanied by witnesses, in the current language script The judge would then proceed with secret investigations, arguments on the basis of evidence, and arrive at a decision based on facts and their true interpretation If the complainant failed to bring forward witnesses, then the denier was to state or deny on oath And the complainant was also to declare on oath Because of the various nature of charges, a number of types of oaths were practised, including the willingness to forego the heavenly reward (to be stated before five Brahmin theologists), and the oath by taking near molten iron piece on the palm of hand These severe oaths do indicate that efforts to enforce justice were made in the Hindu society

All these descriptions are based on *Kitāb al-Hind* which show the very intimate knowledge of the Hindu society by al-Bīrūnī He has provided to the scholars of sociology an effective tool to grasp the historical links of Hindu society and built further elaborative ventures

AL-BĪRŪNĪ AND THE HINDU MIND

PROFESSOR MOHAMMED USMAN

THE writer has in his introductory remarks accepted the praiseworthy realms of the Hindu character and bent of mind, particularly in the fields of contemplation, meditation and sufistic trends, through which their rishis have accomplished significant perfection in pure living Their consideration for even small living creatures and ensuring full precautions not to kill them can, in a broad based civilized frame of mind, be termed a bright and praiseworthy aspect of their character

But despite these good aspects, the thousand years in which the Muslims have deeply studied the Hindu mind has made them conclude that it has more negative than positive aspects The 20th century experience of Sir Syed Ahmed Khan, Poet Iqbal, and Mr Mohammed Ali Jinnah amply indicates that even when with an open mind they desired to build a joint society in India in collaboration with Hindus it seemed impossible to do so On the question of language their narrow-mindedness opened the eyes of these Muslim Leaders, and many others, like Maulana Mohammed Ali Jauhar, Maulana Shaukat Ali, Maulana Zafar Ali Khan, Chaudhry Khaliquzzaman, Maulana Daud Ghaznavi and Mian Iftikharuddin who had all to decide ultimately that it was impossible to alter the Hindu mind

The same was the observation of al Bīrūnī in the 11th century A D , as evident in his scholarly book *Kitāb al Hind* About the Hindus he mentions that they believed themselves to be superior, and whatever knowledge they possessed they liked to be vehemently secretive about it, not even disclose to their own less knowledgeable people They regarded foreigners as dirty (malechcha) and if any of their articles was touched by these foreigners it became dirty For the same reason, they were unfit for consideration in matters of association, marriages, or even eating and living together

Al-Bīrūnī was well aware of the element of bias that could be expressed in the writings of earlier Muslim scholars He was, therefore, not ready to accept their views, but form his own independently And he went to extensive efforts in achieving this, and to present them to the reader in a true spirit of scientific impartiality His aim was to give a matter-of-fact account of the Hindus, to correct

the prejudiced notions prevailing in his time by the work of earlier writers, and to present the picture as it was His deep studies led him to throw light on the monistic lease of Hindu belief in God, and this tended to inspire respect about Hindus among the Muslims who believed in one God His description of the monistic practices of the Hindu rishis and religious elders was also intended to project their high qualities But despite this the Hindu society could not get rid of its traditional caste system and segregation base of each caste in the order of preference A Brahmin could thus get away with minor punishment for a crime whereas a Kshatri may get more severe punishment for the same crime, and a Vaish or Shudra may even face a death sentence for the same crime About Shudra, al-Bīrūnī reveals that he was like a slave of Brahmin, always to serve him, but prohibited to recite the Vedas, to observe the fire sacrifice, and to practise the Mala counting If a Shudra or Vaish was found doing so a Brahmin could get his tongue cut But a Vaish or Shudra could recite prayers to God, do good deeds and offer sacrifices

One can thus say that al-Bīrūnī's effort was to present every aspect, good or bad, of Hindu practices, which threw light on the Hindu bent of mind More than one thousand years have passed since then During this period a vast change has occurred in the world, and the Hindus have not refrained from killing and staying, but the staunch Hindu does not eat beef still Whatever changes have occurred in the Hindu mind during this period would require another al-Bīrūnī to study

AL-BĪRŪNĪ AS MUSLIM HISTORIAN

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I

Trends in Arab-Islamic Culture

FROM a study of early Arab history it will be clear that, within the developing Arab-Islamic society there grew a vivid and dynamic atmosphere of learning with its challenges, responses and tensions It had already begun in Damascus, but it was partly subdued there because the Umayyid capital occupied itself with another round of conquests which carried Arab arms into Spain the Indus Valley and Transoxania, and it also addressed itself to the business of creating an administrative machinery for running the vast empire Besides, the last three decades of the Umayyid rule were chaotic and were spent against revolutionary movements which eventually brought the Abbasids to power (750) Then Baghdad was founded, and into it moved all sorts of people, and into that city poured the wealth of the empire The royal court acquired new and vast dimensions and learning flourished The city has been described as the 'nest of the learned', and although it was the greatest seat of learning, there were other centres, such as Baṣrah and Kūfah and new ones soon developed in the eastern parts of the new empire, particularly within the confines of ancient Persia They were all deeply concerned with matters which centred around God, His messengers, the creation, the universe and, last but not least, man himself

What course did the new intellectual activities, following the period of apprenticeship, take? It has been customary to divide Arab-Islamic intellectual activities into two groups—*al-'ulūm al-naqliyyah* (traditional sciences) pertaining to Islam as such, and *al-'ulūm al- 'aqliyah* (sciences based on reason) covering all foreign branches of knowledge The present writer wishes to take a new departure, and therefore considers the existence of three separate, as much as such a separation in intellectual life is possible, courses which were followed by men of learning The first was one which defined the relation between God and His creation, the second included sciences, both pure and applied, such as medicine, astronomy, physical science, engineering, agriculture and others, the third course covered philosophical thought and Ṣūfism (mysticism)

The first course, which attempted to define the relations between God and man was based on the teachings of the Qur'ān, the revealed word of God, which prescribed faith, the place of man in the creation, his duties towards the Creator and his responsibilities towards his fellow men The *Sunnah* of the Prophet explained, interpreted and complemented what was not clear to men, or lacking in details, of the Qur'ānic injunctions As time went on two Islamic sciences appeared in the first two centuries of Islam· *tafsīr* (interpretation of the Qur'ān) and *hadīth* (the collection and organization of the sayings of the Prophet). The new society, and especially the community of believers, was in need of laws to control its behaviour The arrangement, as already mentioned, of issuing administrative orders to face immediate problems, could not last, with time a large body of *'ulemā* (men learned in the two sciences just mentioned) appeared and they were entrusted with judiciary functions of the state Within less than three hundred years from the death of the Prophet (p b u h) a number of legal schools had come to be known in the world of Islam, and they had all accepted the Qur'ān and the *Sunnah* as bases of their interpretations, but they had already differed about accepting other grounds for legal speculation, namely *ijmā'* (consensus of opinion), *rā'y* (personal opinion) and *qiyās* (analogy) Of the various such schools four came to be recognized and known as rites Mālikī, Ḥanafī, Shāfi'ī and Hanbalī Until late in the ninth century *ijtihād* (personal endeavour to interpret the Qur'ān) had been allowed, men could, naturally within reason, apply their own ways and means for so doing But this changed and any endeavour for any interpretation could be exercised only within the precincts and confines of the four *madhāhib* (sing *madhab*, rite) Thus, by the end of the tenth century the terms of reference for the behaviour of the Muslim community legally, socially, ethically, morally and spiritually, had become clear they were revelation and sharī'āh (Islamic law) Remembering that Islam did always think of life, in its various walks and manifestations, as one unit, we can understand the meaning of the restrictions imposed on interpretations resulting from limiting people's horizons to the four schools

This applied to Sunnism (orthodoxy), for there was an early division in Islam with the appearance of Shī'ism Shī'ism was more flexible it allowed *ijtihād* to continue, and was ready to assimilate foreign ideas But Shī'ism spent its energy in formulating its own doctrines, in establishing its own system of thought and defending both the doctrines and the system against Sunnism Hence, it concentrated on inner problems and failed to develop a philosophy along the Greek lines

The second course which intellectual life in the world of Islam followed dealt with practical aspects of life The various branches of knowledge and practices covering mathematics, physics, astronomy (and astrology), engineering, medicine, pharmacy, agriculture, botanical and zoological sciences, architecture and decorative arts served the society at large and had no conflict with *Sharī'ah*

Then we have the third course philosophical thought and *Ṣūfism* When Muslims became acquainted with Greek philosophy, Neo-Platonism and other similar systems, they used the instruments of such philosophies, as was the case with the various churches that had existed in the area before Islam, to explain the new faith and argue its own stand against other faiths But matters did not stand at this juncture Philosophy had, all along, concerned itself with problems related to the universe, creation, man and above all the nature of the deity It had tried, at various stages of its existence, to probe matters of metaphysical nature Hence when Muslim thinkers had already said the last word, the intellectual enterprise acquired new dimensions and created a complexity of attitudes

The basic issue to which many a Muslim philosopher from al-Kindī (d 870) to Ibn-Rushd (Averroes) who died in 1198 addressed themselves, was an attempt to reconcile reason with revelation or *hikmah* (philosophy) with *sharī'ah* Al-Kindī, the first of the series, considered philosophy as aiming at ascertaining the truth, and a philosopher, he held, should conduct himself in accordance with the truth he discovers To him *sharī'ah* (both law and theology) depended on revelation, while philosophy depended on reason, the instrument of the first was faith while logic was the vehicle of the other As both revelation and reason seek the truth, there should be no contradiction between their results Prophetic truth was, in other words, of the same nature of the truth which is attained by the philosopher

Later philosophers, al-Rāzi (d 925), al-Farābī (Alfarabus d 950), Ibn-Sīnā (Avicenna, d 1073) Ibn Tufayl and Ibn Rushd (Averroes d 1198) differed individually one from the other and some had stronger views about one point or another, but this theme—the compatibility of the two truths—was their primary concern And this very attitude was what made them strangers to the theologians, the *fuqahā'* (sing *faqīh* scholar-jurist) and the *'ulemā*

In its beginning Ṣūfism was considered an ascetic and pietistic form of Islamic faith and worship But this did not continue to be the case Ṣūfism turned out to be a spiritual protest and possibly a rebellion against legalistic Islam Such attitude was partly tolerated But when Ṣūfīs, or at least some of them, began teaching *hulūl* (communion) and similar doctrines, they ceased to be, strictly speaking, faithful Muslims They were accused of *kufr* (atheism) Hence they and the philosophers were grouped, more or less, together

These three courses of Arab Islamic intellectual life enjoyed a period of prosperity and progress as long as two conditions existed, firstly an enlightened regime which patronized learning at large and institutions which provided the necessary haven for workers in such fields *Bayt al-hikmah* of Baghdad is an example of the latter and men like al-Manṣūr, al-Rashīd, al-Ma'mūn and al-Mutawakkil are examples of the former But such situations did not persist The earlier victorious Islamic state later found itself on the defensive internally,

against provincial governors who sought autonomy if not independence, against the royal mercenaries who became masters of the political scene, and against leaders who assumed power and authority over and above the caliphs like the Buyids and the Saljūks Such occurrences would not allow an institution like *bayt al-hikmah* to exist or to be revived On the contrary the way was paved for an alliance between the masters of the political life and the exponents of *sharī'ah* and theology (*'ilm al-kalām*) The ascendancy of these sciences meant the downfall of philosophy and Ṣūfism This is clearly illustrated by the fact that the foundation of the regular official *madrassah* (school) by Nizām al-Mulk, the Saljūkī vizier, and the spread of this religious institution throughout the world of Islam, coincided with the rise of the new masters (Saljūks, Ayyubids and Mamlūks in the East and the Murabitun and Muwahhidun in the West), with the victory of Sunnism (the Fāṭimid Ismā'īlī caliphate of Cairo was brought to an end in 1171) and with the life of al-Ghazzālī (d 1111) Al-Ghazzālī, the most vehement opponent of philosophy and Ṣūfism in the East, was not a cause of the death of philosophy, but rather a sign of the times

Thus the early parallel development of the three faculties or courses of intellectual life in Islam brought the first (religious) and the third (philosophical) to a clash which ended with the complete victory of the first Philosophy flourished in Spain in the twelfth century at the hands of Ibn Bajja, Ibn Tufayl and Ibn Rushd, but it was, so far as the East was concerned a voice in the wilderness With the death of Ibn Rushd (1198) philosophy in the Muslim West also came to an end Ṣūfism, in so far as it contained an element of philosophy, escaped from the Arabs and became a Persian specialty (with the exception of the Andalusian Ibn al-'Arabī who died at Damascus in 1246) What remained of Ṣūfism in the East was what had been sunnized by al-Ghazzālī

One course (the second) of learning continued unmolested by the theologians and authorities the practical sciences and arts which contributed to the welfare of the society—medicine, pharmacy, geography, astronomy, engineering and architecture, etc Not only pursuit of work in these matters continued, but in many cases, certain branches of knowledge reached high points of success and gave excellent fruits of this success

II

Al-Bīrūnī (973—1048) was a leading scientist in his times, if not in all times His interests and studies centred around the universe, including the earth, which he endeavoured to understand and explain both in time and space His tools were, needless to say, astronomy, mathematics and physics His place, in the system outlined in the previous section, is with the second group This paper, however, does not attempt even a slight discussion of the scientist in al-Bīrūnī, for this is the work of people who can do so It attempts, rather, to discern the 'Muslim historian' in the man

The present writer has purposely used 'Muslim historian' and not an historian of Islam, for al-Bīrūnī did not write *a history*—one can almost say that he did not write *history* Whatever historical information, and this was meagre and scanty, included in *al-athār al-Bāqiyah* or in *al-qānūn al-mas'ūdī*, *inter alia*, was never intended for itself and as such, it was brought in because it helped support his interpretation of the calendars (See *al-maqālah al-thāniyah in al-qānūn al-mas'ūdī*)

What is important, in my opinion, is the attitude—I do want to avoid the word philosophy—of al-Bīrūnī to history as a Muslim Before, however, I discuss the man's attitude or concept of history, I would like to make the following observations

One Al-Bīrūnī's faith in Islam was strongly founded, yet the man was not fanatic

Two To him the universal character of Islam and its tenets were things which had similarities in other faiths, because they all recognized the universality of truth (See al-Bīrūnī's India I, 295, S H Naṣr *An Introduction to Islamic Cosmological Doctrines*, 113)

Three Al-Bīrūnī's encounters with cultures and faiths and people whom he studied were unequalled amongst Arab-Islamic authors Many authors in such fields might have traversed wider geographical areas or met a bigger variety of people, but al-Bīrūnī's contacts were deeper and sounder They did not originate from, neither did they result in, mere curiosity The man went about deliberately to appreciate what other peoples, particularly the people of India, had with the purpose of understanding it and transmitting this material to his own people

Four Al-Bīrūnī's writings have a ring of sincerity to which are coupled depth and seriousness

In order to appreciate al-Bīrūnī's attitude to history one has to consider his attitude to the creation of the world, as this was the basis of subsequent history of its inhabitants What is his stand on this issue ?

Al-Bīrūnī accepted the ideas that the world was created *ex nihilo* (من العدم) which is the belief expressed in the Holy Scriptures Thus the Greek concept of the eternity of the world was rejected, and not without proofs We quote at some length from al-Bīrūnī's writing to explain this attitude of his He wrote

> "We have arrived by means of reasoning and correct logical analysis at the knowledge of the newness (ḥādith) of the world For the parts of its limited period during which it has come into actuality and existence, there is a beginning from the time of its inception, but we do not know

by it [that is, by the fact that the world has a beginning] or by accidents (*hawādith*) similar to it the length of the parts of its period which would enable us to know the history of the creation of the world To give an analogy which has such a structure and composition [one can mention] that a body cannot be without the accidents which have been imposed upon it, and whatever cannot be separated from accidents must itself be new Therefore, a body must be new, that is, not eternal It is not possible to have an endless chain of succession because this would lead to the conception of time as being pre-eternal (*azalī*) [that is, "before" the creation of the world and of change] and endless (*lā mutanāhī*), which is false For when we say that past periods of time are able to increase and that every measured quantity which, beginning with one, ends in a definite limit, must itself be finite, and that time also has a beginning and a divinely appointed end, we mean that time has a limit since that which is limitless cannot be bound by anything

As to the knowledge of its parts which have taken specific form or become actualized—that is, past years, months, days, and their lengths —there is no possible way for the mind by analogy to comprehend their actuality

It is conceivable that the beginning of time precedes the creation of the world every moment of the moments of time, which we consider as a twinkling of an eye (*lahzah*), as it is conceivable that it may precede the world thousands upon thousands of years [after] which the world became defined and limited in order to belong to the realm of existence The authority on this subject is what has been heard from a reliable source As to the Book of God Most High and the correct works, they have not said anything about this matter at all And as far as the people of the Book, the Jews, Christians, and others, from the Sabaeans and Zoroastrians, are concerned, they are in agreement as to the history, beginning with the first man, but they differ greatly with regard to the length of time involved As to the creation of the world, it was not dealt with by them except in the case of the opening of the Torah of which the following is the meaning, if not the exact words

"In the beginning God created the heaven and the earth, and the earth was in chaos and the spirit of God moved upon the face of the waters" They claim that that was the first day of the week in the creation of the world, yet that is a period which cannot be measured in day and night because the cause of day and night is the Sun, its rising and setting But the Sun along with the Moon was created on the Wednesday of that week, how then is it assumed that in those days the period was like what we count now? Revelation states that "a day with your God

is like a thousand years of what you count," and in another place· " . on a day whose duration is fifty thousand years ." Therefore, it was known that that period was not measured with what we measure it by now, and that there is no way to verify it at the beginning of creation "

(See S H Naṣr, *ibid*, pp 116-7)

This is how al-Bīrūnī conceives of time, of the creation of the world, of the appearance of man on this earth and the subsequent development of the human race (See on these points al-Bīrūnī's *India*, I 152, 170, 400-401, *Chronology of Ancient Nations*, Sachau's *English Translation of Al-Āthār al-Bāqiyah*, 91-92, 93, 97, 115-116)

III

There is another aspect where al-Bīrūnī, while keeping the integrity of his belief, did render a great service to history as a Muslim historian In our age, where specialization in the various fields of knowledge has become a disease, my coming statement will be considered as an affront on anthropology, sociology and comparative study of religions But al-Bīrūnī and his contemporaries considered the activities of the mind as numerous facets of human knowledge, we might as well respect their views in the matter It is thus assumed that al-Bīrūnī's discussion on India pertains as much to the field of history as to other aspects of knowledge

One of the best studies on this particular contribution of al-Bīrūnī is that of A Jeffery (See *al-Bīrūnī Commemoration Volume*, Calcutta, 1951, pp 125—160) Jeffery laid emphasis on the methodology of al-Bīrūnī in treating with this subject He wrote

"When al-Bīrūnī is discussing the religion of the Jews or the Christians of his day, the Greeks or the Zoroastrians, the Hindus or the Buddhists, or even the religion of the Manichaeans, he is dealing with matters on which we have today source material much superior to that which was available to him For this reason, while what he has to say about these religions has considerable interest for us, our main interest today is in his methodology "

He goes then to analyse the various aspects of this methodology and finds that al-Bīrūnī's work was characterized with completeness, accuracy and unbiased treatment Jeffery says on the issue of unprejudiced presentation of the religions of other peoples

"Al-Bīrūnī is conscious of the fact that Muslim authors are far too prone to misrepresent the teachings of other religions, or even those of other

sects of their own religion, when they come to write of them He had found this true in their accounts of the rationalistic Mu'tazilites (*India*, 3), and in the Introduction to his *Chronology* he also has to complain of the numerous lies he found mixed up with all the historical records (*Chron* , 5) Again in speaking of the work of Abū Ma'shar (*Chron* , 26), he takes occasion to refer to the foolish people who abuse all religions This unfortunate habit of allowing partisanship to enter into scholarly discussion he deplores because it makes even clear—seeing eyes blind and clear—hearing ears deaf, and pushes men into following paths that their intellects would bid them never follow (*Chron* , 66) This reproach of prejudice is levelled not only against the uneducated, for even among the learned he has found that there are those so enamoured of their own theories, and so fully persuaded that they are much superior to others, that instead of examining evidence in an impartial spirit they wrinkle up their noses in a grimace of disdain, or laugh in mockery (*Chron* , 84) This defect is not confined, of course, to Muslims He is able to quote a warning example of Brahmagupta's blind hatred and abuse of Āryabhata (*India*, 189), and the lies Syncellus tells about the Sabaeans (*Chron* , 205)

His method, on the contrary, will be to make no unfounded imputations against other religions even though its adherents are antagonistic to his religion (*India*, 7) The correct scientific method is to deduce the facts about another religion from the statements of its adherents, even if you yourself do not believe in them (*India*, 3) Such an investigator *will set forth the ideas of these religions, not in order to refute them,* but merely as an historical record of the facts (*India*, 3, 13, *Chron* , 332) Such, he says, his work on India will be He will place before the reader the various theories of the Hindus exactly as he finds them to be, and for illustrative purposes, to make them clearer and more intelligible, he will bring into connection with them such theories of the Greeks as he finds to be similar to them "

I hope I have been able to draw the attention of the students of al-Bīrūnī to an aspect of the intellectual achievements of this thinker which has not been carefully examined, and which I hope to be able to examine more thoroughly at some later occasion

AL-BĪRŪNĪ ONE THOUSAND YEARS LATER

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Preface

What can a political scientist whose field of study focuses on contemporary political life say about the work of Abū Raiḥān Muḥammad ibn al-Bīrūnī? This was the principal question raised by your gracious invitation and it is not overstated when I note that long hours have been spent in finding an acceptable answer My initial inclination was to draft an impressionistic piece outlining specific connections between al-Bīrūnī's scholarship and the present period It has been often stated that al-Bīrūnī was in advance of his time On this, his one thousandth birth anniversary, it can be argued that he still is My original intention therefore seemed to be the most relevant theme I could pursue It was one which a non-expert in mediaeval Indian and Muslim history might involve himself without seeming to stretch his credentials Hence my decision is to briefly discourse on what appears to me to be one aspect of the contemporary value of al-Bīrūnī's endeavour

An Extrapolation

My source is Edward C Sachau's translation of *Alberuni's India* In this paper I refer exclusively to Chapter XI of Volume One which is entitled "About the Beginning of Idol-Worship, and a Description of the Individual Idols" I am drawn to this chapter not because it tells us about Hindu religious custom and ritual but because it reveals something at once timeless and at the same time universal in the human character From the outset al-Bīrūnī is concerned with the uneven division of humanity into educated and uneducated groups and the great problems involved in raising the consciousness of the masses He writes

> It is well known that the popular mind leans towards the sensible world, and has an aversion to the world of abstract thought which is only understood by highly educated people, of whom in every time and every

place there are only a few. And as common people will only acquiesce in pictorial representations, many of the leaders of religious communities have so far deviated from the right path as to give such imagery in their books and houses of worship, like the Jews and Christians, and, more than all, the Manichaeans (I, p 111)

Following up this thought with an illustration that suggests Muslims can suffer from the same dilemma al-Bīrūnī comments

"These words of mine would at once receive a sufficient illustration if, for example, a picture of the Prophet were made, or of Mekka and the Ka'bah, and were shown to an uneducated man or woman Their joy in looking at the thing would bring them to kiss the picture, to rub their cheeks against it, and to roll themselves in the dust before it, as if they were seeing not the picture, but the original, and were in this way, as if they were present in the holy places, performing the rites of pilgrimage, the great and the small ones" (I, p 111)

The power of these words cannot be avoided Al-Bīrūnī is an apt and perceptive interpreter of human character He at once realizes how ignorance at first mystifies and then leads men to accept authorities which may or may not be in their interest Idols, he suggests, are created to provide the uneducated with a material replication of that which demands their respect and homage Over time such monuments become a matter of ritualistic veneration and subsequent generations are kept in awe by authorities who sense their success is linked with the symbol being venerated As they grope for answers to their existence, the unsophisticated become objects of manipulation and in most instances gladly give themselves over to the machinations of others

The student of contemporary affairs cannot ignore such ideas Symbols are of essential significance in the modern world Who can deny that the mobilization societies of the current era are nothing without their emblems, banners, pictorial displays, and indeed, their idols Nazi Germany and Fascist Italy are prime examples in the use of rituals and ceremonies to rally their semi-informed, highly indoctrinated subjects Those who would counsel against falling under the spell of the symbol-makers are soon made suspect and, history cites, quickly ostracized Nevertheless, there are those who refuse to succumb to ignorance or betray their calling Al-Bīrūnī alludes to them when he explains

"For those who march on the path to liberation or those who study philosophy and theology, and who desire abstract truth which they call *sāra*, are entirely free from worshipping anything but God alone, and would never dream of worshipping an image manufactured to represent him" (I, p 113).

True faith according to al-Bīrūnī requires no external reward or experience Truth is the purpose of knowledge and it is through knowledge that man comes to grip with himself and his creator Intertwined with this realization is selflessness and compassion And al-Bīrūnī's account of a Hindu tradition brings him to recite the Lord's message to a king whose goal is knowledge not power

> "Occupy yourself with your empire in as straight forward and prudent a way as possible turn your thoughts upon me when you are engaged in civilising the world and protecting its inhabitants, in giving alms, and in everything you do" (I, p 115)

Although the above quotation is incomplete and actually aims at proving for al-Bīrūnī how idol worship emanates from a desire to be in the presence of the eternal, it also stands to demonstrate the power of mind over matter

But lest the point be lost if should be explained that al-Bīrūnī was not one to deny even idols their place The requirements of a population for representations of that which they can never see and only sense cannot be discounted Al-Bīrūnī does not argue in favour of spreading education among the masses In fact, his purpose is almost never prescriptive As a chronicler of his time it is his singular objective to describe to his co-believers how others, and in this particular case, the Hindus, conduct themselves He is no idol destroyer, nor is he an apologist He is moved, however, by the intolerance exhibited by Muslims and Hindus toward each other He is equally appalled by the rivalry existing between Muslim conquerors and in the following sequel seems to emphasize the need of Muslims and Hindus to find common ground upon which to sustain their traditions In part the text reads

> "A famous idol of theirs (the Hindus) was that of Multān, dedicated to the sun, and therefore called Āditya It was of wood and covered with red Cordovan leather, in its two eyes were two red rubies It is said to have been made in the last Kritayuga Suppose that it was made in the very end of Kritayuga, the time which has since elapsed amounts to 216 432 years When Muḥammad Ibn Alkasim Ibn Almunabbih conquered Multān, he inquired how the town had become so flourishing and so many treasures had there been accumulated, and then he found out that this idol was the cause, for there came pilgrims from all sides to visit it Therefore he thought it best to have the idol where it was, but he hung a piece of cow's flesh on its neck by way of mockery On the same place a mosque was built When the then Karmatians occupied Multān, Jalam Ibn Shaibān, the usurper, broke the idol into pieces and killed its priests He made his mansion, which was a castle built of brick on an elevated place, the mosque instead of the old mosque, which he ordered to be shut from hatred against anything that had been done under the dynasty of the Caliphs of the House of

'Umayya When afterwards the blessed Prince Mahmūd swept away their rule from those countries, he made again the old mosque the place of the Friday-worship, and the second one was left to decay At present it is only a barn-floor, where bunches of Hinnā (Lawsonia inermis) are bound together" (I, pp 116-117)

Perfect harmony between opposed cultures is a recognized impossibility but mutual understanding and cooperation are not beyond the reach of well-intentioned leaders In the episode mentioned above it is important to grasp the pre-eminent role of leadership in bridging the vast distances existing between peoples If this means acquiescing in the maintenance of specific rites, or overlooking the features of another culture which the beholder may judge grotesque because it is so alien to his own, it would be best to so behave Rather than allow differences to influence our behavior it would be constructive if more attention were given to the excitement and even beauty that is demonstrated by our diversity The existing variety of human customs and preferences should be a stimulant to learning And from such efforts a larger concept of community might become possible without threatening the peculiar belief system of the individual or group

One is drawn to establish a linkage between al-Bīrūnī and those who are identified with the later Bhakti Movement The author has searched in vain for such a connection although I must again stress my lack of depth in this field But assuming that al-Bīrūnī is not to be associated with the Bhakti Movement it is still intriguing to speculate as to how it began Monotheism is perhaps the principal theme of the Movement and it is noteworthy that al-Bīrūnī sought to emphasize Hinduism's monotheistic properties Moreover, Islam is said to have influenced Hinduism in such a way as to cause the Hindus to revitalize this aspect of their beliefs In the tenth century the idea of a personal God gained wide appeal and this is also true in northern India where Vaisnava devotees came in contact with al-Bīrūnī

Al-Bīrūnī's work stresses love and piety and his pursuit of knowledge is in keeping with his strong emotional convictions Moreover, in Bhakti, devotion to the Creator who is all-knowing and all-powerful, not caste and its demands, took on greater significance By de-emphasizing the importance of caste the followers of Bhakti also promoted an egalitarianism not easily associated with this historic period or environment Could al-Bīrūnī have experienced Bhakti? If he did could this have influenced his writing? And if he did, then why does he not mention it? If he did not, how do we account for his implicit notions that Muslim and Hindu communities have much to learn from one another, and indeed, that God is not different for Hindus and Muslims This latter view is one put forward with exceptional energy by those genuinely identified with the Bhakti Movement such as Ramananda and Kabir

Al-Bīrūnī, however, does make mention of the egalitarian principle which is

later attributed to these recognized leaders of Bhakti Long before their emergence he was aware of the preponderant power wielded by the Brahmin caste His insistence that only enlightenment or intelligence separated man from man and provided the Brahmins with the leverage required to keep lower castes controlled is seen in scattered portions of his treatise The educated man, he argues, knows all castes are equal More important in the context of this essay, however, al-Bīrūnī declares that even "friend and the foe, the faithful and the deceitful" are equal He further comments "If to the eyes of intelligence all things are equal, to ignorance they appear as separated and different " (Sachau, II, p 138) The latter theme as we remarked earlier is central to al-Bīrūnī's scholarship He seems to opt for the contention that scholars can communicate with each other However, he apparently sees little chance their work will have much meaning for those who, on the one hand, would perpetuate their status through the exploitation of ignorance and, on the other, that great mass of humanity who can never know true wisdom and are destined to follow the dictates of their fears and misperceptions

Al-Bīrūnī, it is agreed, is influenced by the renowned Greek philosophers and there is a Platonic philosopher-king treatment in his writing Al-Bīrūnī's philospher-king, however, is above all wise in the ways of humanity and tolerant of differences He is perennially curious and always a student and scholar He is therefore not so much one who rules but one who resolves disputes, promotes goodwill, and constantly expands the circle of consciousness

Observed in a contemporary context al-Bīrūnī's purpose has not been well served While the circle of intellectuals has grown, so has that of the ignorant, unaware and information-poor Moreover, authorities still manage to reap advantages from those who respond more from instinct than knowledge Xenophobia is virtually synonymous with the state of mind known as nationalism and exclusive characteristics not universal norms are fashionable Mutual suspicion increases tension and hostile action is a direct outcome of orchestrated fear Instead of constructing a foundation for the amelioration of disputes, nationalism gives unusual importance to particular cultures It is the resulting conflict between antagonistic and/or competing culture-units whether across or within the frontiers of a state that makes for the current global disequilibrium

Having taken the discourse this far it seems only proper to comment on the current global situation How would al-Bīrūnī, were he travelling among us today, chronicle the events of the last two and a half decades? And what might he say about the immediate present? In my judgement one thing above all others would be paramount in his writing He would note that society is still very much divided between those who are informed and those who are not He would quickly conclude that this being so, the stability of society and the purpose of civilization rests with those who have the power, wisdom and compassion to moderate differences and institutionalize ceremonies and rituals which diverse peoples

can adopt without threatening their peculiar life-styles Harmony not homogenization, cooperation not transformation is required All people have a tendency to revere leaders both living and dead who they sense can protect them from adversity The significance of this statement is verified by al-Bīrūnī in the chapter that I have referred to in the beginning of this paper and from which I have already drawn numerous quotations In this instance al-Bīrūnī continues his treatment of idol worship but his comment supports the point made above He writes

> "The Hindus honour their idols on account of those who erected them, not on account of the material of which they are made" (I, p 121)

In spite of the desire to move away from idolatry, the inability to raise the level of informed consciousness suggests the preservation of the custom in one form or another As noted earlier, the modern state can demand obedience even in the face of what wise men judge to be irrational policy Popular support for such state policies in many respects is not different from the unquestioning obedience involving idol worship in al-Bīrūnī's time What remains constant, therefore, is the need to understand national xenophobia so that it can be constrained Al-Bīrūnī comments on his reasons for presenting an explanation of Hindu idol development and usage, and perhaps he has something to say to us in regard to outcoming to grip with nationalism

> "Our object in mentioning all this mad raving was to teach the reader the accurate description of an idol, if he happens to see one, and to illustrate what we have said before, that such idols are erected only for the uneducated low-class people of little understanding, that the Hindus never made an idol of any supernatural being, much less of God, and lastly, to show how the crowd is kept in thraldom by all kinds of priestly tricks and deceits"

And to follow up this thought with a subsequent passage

> "When the ignorant crowd get a piece of good luck by accident or something at which they had aimed, and when with this some of the preconcerted tricks of the priests are brought into connection, the darkness in which they live increases vastly, not their intelligence They will rush to those *figures* of idols, maltreating their own figures before them by shedding their own blood and mutilating their own bodies"

Finally, al-Bīrūnī says idols may have their place but there is no avoiding the reality that their use has "become a foul and pernicious abuse"

Nationalism too has its positive aspects but the essential dilemma is the negative force that it has become In its original humanitarian and intellectual form,

nationalism symbolized a belief in popular government, limited in its role and use of power Sovereignty supposedly belonged to the people, and government merely reflected the interests of the ethnic and religious congeries comprising the nation While political unity was hopefully sustained through the perceived enhancement of one's future by membership in the polity, individuals and groups were considered free to conduct their personal-cum-social lives unfettered by control of any kind Individuality, and hence self-expression, were salient to democratic nationalism *Self determination* became the all-encompassing term which signified the right of a people to transform their cultural distinctiveness into political reality It was believed that only when the latter was made manifest did the former have a chance to survive No doubt the intentions of the early nationalists were both high and noble But something went wrong with the quest for nationalist self-expression

The humanitarian character of nationalism was long ago swallowed up in an effort to give it concrete form Instead of freeing people from the strictures of arbitrary government, populations were made subservient to authority which came to represent the immortality of the nation-state The threat posed to the nation-state, whether real of imaginary, could only be met by the combined actions of a total population whose supreme loyalties were owed maximum rulers Fear therefore again proved more responsive than intelligence, and it is fear that has made a mockery of nationalism

Now how does this apply to the situation in the subcontinent? *Self determination* is no panacea as history can witness Too much human sacrifice has already been spread upon the altar of national purpose And this is certainly not to deny the individuality of nation-states, their independence or raison d'etre It is, however, essential to realize from where we have come and to what we are tending Leadership is not infallible Nor is nationalism in itself an acceptable final objective This technotronic era requires recognition of the inchoate nature of nation-states National sovereignties are by themselves unable to protect the humanity confined within their respective frontiers Interdependence is an important feature of international life No country is self-sufficient and all look to others to compensate for their intrinsic weaknesses It is foolish to worship the nation-state as primitive people worship their gods The nation-state has much to offer its citizenry but it only represents one community among many, and it is the community of communities that promises a way out from the dilemmas of poverty, environmental degeneration and war

And how, you might ask, is this new direction to be taken? Clearly, the responsibility rests with those who have the power and the accompanying wisdom and compassion to recognize the necessity for action The statesman who is more concerned with protecting the status quo may be safe among his constituents, but his policies address themselves to sterility and ultimately to oblivion It is only those leaders who are capable of reaching beyond the experience of

the masses who must transform their visions of tomorrow into the realities of popular experience today if chaos is to be avoided Such leaders must stand prepared to receive the vilification of their political opponents who sense a loss of state sovereignty But such has always been the case of men whose performance and thought have out-distanced their own times Prophets are usually misunderstood in their own day It is only after they have passed from our world that recognition of their great work is sometimes appreciated

If al-Bīrūnī were a statesman instead of a scholar, if he lived today instead of a thousand years ago, there would be much unfinished work for him to consider We who are assembled here to commemorate the millenary of al-Bīrūnī are not statesmen but we do represent that scholarship which meant so much to this early thinker It is incumbent on us to labor as al-Bīrūnī labored to make the world a more intelligible place You will permit, I trust, a political scientist to end with a quotation from one of the masters of his contemporary discipline Harold Lasswell has written

> "The question is whether the accelerating impact of the common world map will so modify systems of identity that members of sub-elites and mid-elites will refrain from blocking initiatives that contribute to the consolidation of a more potent and instantaneously operative system of public order As systems of identity with all men eclipse identities with *some* men, the prospects of universal public order are improved "

*Harold Lasswell, "Future Systems of Identity in the World Community," in C E Black and R A Falk, eds *The Future of the International Legal Order*, Volume IV *The Structure of the International Environment*, Princeton University Press, 1972, p 15

PHILOSOPHY SECTION

ENCOUNTER OF CULTURES IN THE WORK OF AL-BĪRŪNĪ

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ONE of the main characteristics of Islamic civilization is that it has succeeded in combining several heterogeneous elements into a reasonably consistent whole. Its original roots lie in pre-Islamic Arabic culture, but it later incorporated most theoretical and practical elements of Hellenistic and Iranian Middle Eastern civilization. All these and some other elements are in the last instance coordinated by the Qur'ān and the Sharī'ah. Islamic culture created a common pattern of thought and conduct, and it gave a common distinctive imprint to different peoples with different backgrounds. Even when the political power of Islam was somewhat in decline in the later Middle Ages, the cultural consciousness of the Islamic World was only strengthened, as G. von Grunebaum points out in his book "*Islam. Essays* " p. 44. In the same connection von Grunebaum stresses the fact that "It is the very specific feeling of the culture-conscious Muslim for the style of Islamic life, for what is and what is not compatible with his manner of thinking and, even more so, of living which enabled Bīrūnī (d. 1048), a scholar unrivalled in Islamic science, to develop and apply in his book on India that descriptive attitude towards another civilization which on the whole has been a distinctive trait of the West" (*Ibid.* p. 48)

It is of course true that al-Bīrūnī's book on India is almost unique in its kind among medieval Islamic literature. No one else ever made in those days such an extensive and profound study of an alien civilization, of its religion, philosophy, manners, customs and scientific achievements, together with a comparison of corresponding features in the writer's own and other known cultures. Still one must bear in mind that other writers had worked on similar lines before him. One could mention especially al-Mas'ūdī and his *Murūj al-dhahab*. The work is essentially an universal history, in the first part of which the author also tries to make his readers acquainted with various aspects of ancient and contemporary civilizations. Of course al-Mas'ūdī is much more superficial than al-Bīrūnī, his work is marred by a lack of order and concentration, and he ostensibly tries to entertain his readers with a variety of subjects in

the style of adab-writers like al-Jāḥiz On the other hand, *Murūj al-dhahab* is only an abbreviation of a much larger work, and if the whole production of al-Mas'ūdī had been preserved, our judgement of him would perhaps be different On the whole his general outlook is very similar to al-Bīrūnī's, though, the uniqueness of al-Bīrūnī lies above all in his great penetration He had the opportunity and will-power to study Indian writings in the original and to form an independent judgement on them In addition, he was thoroughly versed in the science of his time and was really able to appreciate the Indian achievements in the various fields which he studied

As can be seen from the above-mentioned quotation of von Grunebaum, a Western scholar is inclined to see in al-Bīrūnī a very exceptional figure among Islamic scholars of the Middle Ages on account of his broad-mindedness and openness to alien culture It would, however, be wrong to characterize him as a phenomenon diverging from the general line of Islamic thought We must not forget that a similar open-mindedness towards foreign cultures and their achievements was characteristic of the most creative period of Islamic culture at the time of the first 'Abbasid Caliphs The same avidity to assimilate foreign cultural elements was bound to appear again when Maḥmūd al-Ghaznawī's military exploits opened new areas for Islamic expansion Al-Bīrūnī's activity does not reflect his own creative personality only There was also something in the general mood of his time that encouraged such activity On the other hand, al-Bīrūnī was the very personality whose previous work and background made him supremely able to conduct a line of research the results of which are laid down in his book on India As a native of Khwārizm he had been compelled to learn both Arabic and Persian as foreign languages Many of his works, e g the *Chronology of Ancient Nations* and his book on Pharmacognosy, reflect a keen interest in foreign languages and popular, mostly Iranian, dialects It seems that he had developed mental qualities which made him more prepared than most of his contemporaries to undertake the study of Sanskrit The work on Ancient Chronology also reflects his early interest in cultures outside Islam One can observe that he is exceptionally well informed about such specialized subjects as the textual history and variants of the Old Testament, the specific doctrines of Jews and Christians on the Messiah, the festival calendars of Christians and Zoroastrians, not to speak of astronomical methods of calculating the dates of various eras and chronological systems As many of his contemporaries, he has a truly encyclopedical mind He is interested primarily in mathematics, astronomy and natural sciences, but almost as much in different religions and in philosophy With these qualifications he really was the chosen man in his time to embark on the study of the Indian culture

Still such studies were hampered by special difficulties Al-Bīrūnī himself describes them in the first chapter of his book on India The first thing is the linguistic barrier separating the Islamic world from the Indian world "If you want to conquer this difficulty (i e to learn Sanskrit), you will not find it easy,

because the language is of an enormous range, both in words and inflections, something like the Arabic, calling one and the same thing by various names, both original and derived and using the same word for a variety of subjects, which, in order to be properly understood, must be distinguished from each other by various qualifying epithets" (*India* I, p 17)[1] Al-Bīrūnī then goes on describing the specific difficulties of Sanskrit and gives, as Louis Renou has pointed out in his "*Histoire de la langue Sanskrite*" (p 91), an "admirable definition of Sanskrit" As an additional difficulty he mentions the habit of Indian scholars of composing all their scientific treatises in metrical form, which in turn necessitates the use of several synonyms in order to fulfil the requirements of metrical form and tends to make every subject obscure and complicated "Now it is well known that in all metrical compositions there is much misty and constrained phraseology merely intended to fill up the metre and serving as a kind of patchwork, and this necessitates a certain amount of verbosity" (*Ibid* I, 19)

In the conditions of his time it is really one of the most astonishing accomplishments of al-Bīrūnī that he managed to acquire at least a partial knowledge of the Sanskrit language Already E Sachau has, however, demonstrated that his knowledge was not perfect Sometimes he makes mistakes in the division of Sanskrit compound words, or he does not recognise the compounds with - *adya* "etc" and the like But considering the conditions he worked in, it would indeed have been miraculous if he had succeeded in acquiring a complete command of that difficult language He did not have grammars and dictionaries at his disposal as a modern student has He had to learn Sanskrit "by the nature method", as it is said nowadays, and he never had occasion to familiarize himself with the Indian grammatical system, which is very complicated, not like our modern grammars with paradigma etc In any case he learned enough to be able to form an independent judgement on the contents of the books he studied In the field of the theory of translation his merits are perhaps still greater As is well known, translation methods in antiquity and in Middle Ages were often very imperfect Translators tended to be extremely literal and to substitute a certain word of the target language for a certain word of the original, without considering whether the result was intelligible or not Al-Bīrūnī's method was rather to remould the text, at the same time he was also careful to retain the original terminology when it was not directly translatable As a whole, al-Bīrūnī's work in editing the book on India, his translations of Sanskrit works into Arabic and from Arabic to Sanskrit (if the latter ones actually were realized), constitute an epoch-making contribution to the art of translation

Another difficulty which he deplores was caused by religious and national prejudices "They (the Hindus) totally differ from us in religion, as we believe nothing that they believe, and vice versa" Although the Hindus have several religious sects they seldom fight each other because of them (contrary to what

[1] The references are to the English translation of E Sachau, London, 1910

Muslims had sometimes done) "Instead, all their fanaticism is directed against those who do not belong to them—against all foreigners They call them *malechcha*, i e impure, and forbid having any connection with them " (I, p 19) "They are by nature niggardly in communicating that which they know, and they take the greatest possible care to withhold it from men of another caste among their own people, still much more, of course, from any foreigner According to *their belief, there is no other country on earth but theirs, no other race of men but* theirs, and no created beings besides them have any knowledge or science whatsoever Their haughtiness is such that if you tell them of any science or scholar of Khurasan and Persia, they will think you to be both an ignoramus and a liar If they travelled and mixed with other nations, they would soon change their mind, for their ancestors were not as narrow-minded as the present generation is" (I, p 23)

Al-Bīrūnī does, however, find some attenuating circumstances that serve to explain, and to some degree to excuse, the attitude of the Hindus towards foreigners It has been created by past and present wars and differences between East and West The contrast had only been deepened by Maḥmūd al-Ghaznawī's recent conquests "Maḥmūd utterly ruined the prosperity of the country, and performed there wonderful exploits, by which the Hindus became like atoms of dust scattered in all direction, and like a tale of old in the mouth of the people Their scattered remains cherish, of course, the most inveterate aversion towards all "Muslims" (I, p 22) So the conditions that helped al-Bīrūnī himself to visit India and to accomplish his studies formed, at the same time, an obstacle to them Al-Bīrūnī seems to think that after all, a more fruitful encounter of cultures could have come about without devastating wars and without creating animosity and hatred between peoples

It would be fascinating to know how al-Bīrūnī overcame these difficulties and how he succeeded in entering into the confidence of at least some Hindu scholars Unfortunately he does not give us too many details about this He only mentions the following "At first I stood to their astronomers in the relation of a pupil to his master, being a stranger among them and not acquainted with their peculiar national and traditional methods of science " Then he gradually began to reveal to his teachers what he himself previously knew about the respective sciences in their Arabic form "They almost thought me a sorcerer, and speaking to their leading men in their native tongue, they spoke of me as *the sea or as the water which is so acid that vinegar in comparison is sweet*" (I, p 23-24)

The first impression of everyone who comes into direct contact with an alien culture is the inevitable strangeness of manners and customs of everyday life One feels bewildered and irritated by differences of behaviour and conduct, and is led to believe that individuals who have been born and raised in a different civilization are somehow radically different This feeling is reflected in the

writings of al-Bīrūnī, too After having dealt with Hindu religion, philosophy and language, al-Bīrūnī comes to speak on "Strange manners and customs of the Hindus" (end of Ch XVI I, p 179 seqq) in a way that is reminiscent of Herodotus' description of Egyptians who do every thing in a way opposite to that of other peoples "Many Hindu customs differ from those of our country and time to such a degree as to appear to us simply monstrous One might almost think that they had intentionally changed them into the opposite, for our customs do not resemble theirs, but are the very reverse, and if ever a custom of theirs resembles one of ours, it has certainly the opposite meaning" Al-Bīrūnī then mentions details of Hindu hygiene, eating manners, clothing, sexual customs, social conduct (and, somewhat surprisingly in this connection, their method of playing chess) Then he concludes (I, p 185) "If the Hindus claim to differ from us, and to be something better than we, as we on our side, of course, do vice versa, we might settle the question by an experiment to be made with their boys. I never knew a Hindu boy who had only recently come into Muḥammadan territory who was not thoroughly versed in the manners and customs of the people, but at the same time he would place the shoes before his master in a wrong order, the right one to the left foot, and vice versa, he would, in folding, turn his master's garments inside out, and spread the carpets so that the under part is uppermost, and more of the kind All of which is a consequence of innate perversity of the Hindu nature (in the original *Li-m īfi'l gharīzah min in'ikāsī al-tabi'ah* "because it is in the nature to do instinctively the opposite thing")

We have to be careful in interpreting this passage, because when quoted out of context, it would seem to support a narrow racialist outlook As a matter of fact, al-Bīrūnī is making a *reduction in absurdum* of the Hindu view that they belong to a superior race Different civilizations have different manners and customs Some of the differences are of small importance but they are deeply rooted in the behaviour of individuals who have been born and raised inside a certain civilization In another civilization where the manners and customs are different, the representant of an alien civilization will "betray himself" by small details of behaviours which look absurd or ridiculous in the eyes of the spectators The alleged racial superiority thus boils down, from the point of view of representants of another civilization, to a tendency to do everything in a way opposite to what is expected

This does not, of course, mean that al-Bīrūnī approves of everything that the Hindus do He is firmly convinced that many of their manners and customs, e g some unnatural kinds of marriage which he mentions in Ch X (I, p 108) really are vicious and abominable, although he is able to quote parallels to them from Jewish and Magian law and ancient Arab customs He remarks on them as follows (I, p 110) "We have here given an account of these things in order that the reader may learn by the comparative treatment of the subject how much superior the institutions of Islam are, and how much plainly this contrast brings

out all customs and usages, differing from those of Islam, in their essential foulness " Similarly, he remarks on the chapter XVI quoted above "However, I must not reproach the Hindus only with their heathen practices, for the heathen Arabs too committed crimes and obscenities They cohabited with menstruating and pregnant women, several men agreed to cohabit with the same women in the same period of menstruation, they adopted the children of others, of their guests, of the lover of their daughter, not to mention that in some kinds of worship they whistled on their fingers and clapped with their hands, and that they ate unclean and dead animals Islam has abolished all those things among the Arabs, as it has also abolished them in those parts of India the people of which have become Muḥammadans Thanks be unto God " (I, p 185-186)

It is thus obvious that according to al-Bīrūnī, Islam is not only a certain faith and confession but a manner of life, a complete code of daily behaviour Religion and culture form an inseparable whole, and one of the merits of Islam is that it has raised a large part of mankind to a decent way of life Al-Bīrūnī is in this respect really very culture-conscious, and he is at the same time firmly convinced of the superiority of his own culture, not on a racialist basis, but on the basis of a superior ideology, if such an expression can be applied to al-Bīrūnī's Islam As von Grunebaum says in the above quotation, he had "the very specific feeling of the culture-conscious Muslim for what is and what is not compatible with his manner of thinking and, even more so, of living "

As regards the manner of thinking, al-Bīrūnī is perhaps really more lenient towards the Hindus than in matters pertaining to manner of living He begins his treatment of Hindu religion and philosophy by a definition of their concept of God "The Hindus believe with regard to God that he is one, eternal, without beginning and end, acting by free-will, almighty, allwise, living, giving life, ruling, preserving, one who in his sovereignty is unique, beyond all likeness and unlikeness, and that he does not resemble anything nor does anything resemble him" (I, p 27) The astonishing thing about this definition is that it resembles rather closely some orthodox Islamic definitions, e g the one translated from the *Bahr al-Kalūm of Abūal-Mu'īn* in Jeffery's *Reader on Islam* p 376 "I teach that Allah—may He be exalted—is one, unique, primordial, everlasting, that He is eternal, the One Who has no partner, Whom nothing is like and nothing resembles, Who has no shape, against Whom none contends and to Whom none is equal, Who has always been alone, one, unique, single, and Who will always be so for ever He is the One Who is perfect in his essence, everlasting in His attributes, He Who transcends imperfection He is the all-knowing One, with Whom there is no forgetfulness, the Omniscient to Whom there are no uncertainties, Who was in existence before space was created, before time and temporality came into being" Al-Bīrūnī does not comment on possible discrepancies between the Hindu concept of the Supreme Being and the God of the Islamic Revelation Instead, he supports his definition by some quotations from the book of *Patanjali*, from the *Gita* and the *Samkhya*, and adds "This

is what educated people believe about God They call him *i'svara*, i e self-sufficing, beneficent, who gives without receiving They consider the unity of God as absolute, but that everything beside God which may appear as a unity is really a plurality of things The existence of God they consider as a real existence, because everything that exists, exists through him It is not impossible to think that the existing beings are not and that he is, but it is impossible to think that he is not and that they are " (I, p 31) What he says here really comes closer to specifically Indian ideas about "God", but I doubt whether it does full justice to their subtlety, not to speak about the fact that the personal God as portrayed in the Qur'ān is very far indeed from all Indian conception The pagan gods (*devās*) about which the Indian myths speak, al-Bīrūnī classifies as angels and concedes that some of the myths are crude and objectionable "You must not wonder if the Hindus, in their stories about the class of the Deva, whom we have explained as angels, allow them all sorts of things, unreasonable in themselves, some perhaps not objectionable, others decidedly objectionable, both of which the theologians of Islam would declare to be incompatible with the dignity and nature of angels " (I, p 95)

As to the Indian idol-worship, most objectionable from the Muslim point of view, al-Bīrūnī is of course well aware of its existence He even quotes a handbook for the construction of idols, but is at the same time at pains to point out that no educated Hindu will identify these idols with the Supreme Being "For those who march on the path to liberation, or those who study philosophy or theology, and who desire abstract truth which they call *sara*, are entirely free from worshipping anything but God alone, and would never dream of worshipping an image manufactured to represent him" (I, p 113)

On the whole al-Bīrūnī thinks that the Indian religion is closely parallel to ancient Greek philosophy and even to Ṣūfī mysticism in the realm of Islam When discussing the Indian philosophical and religious tenets he constantly refers to Greek and occasionally to Ṣūfī parallels Very penetrating is the remark "As the word of confession, 'There is no god but God, Muḥammad is His prophet,' is the shibboleth of Islam, the Trinity that of Christianity, and the institute of the Sabbath that of Judaism, so metempsychosis is the shibboleth of the Hindu religion Therefore he who does not believe in it does not belong to them, and is not reckoned as one of them" (I, p 50) However, he does not fully appreciate the importance of this doctrine for the Indian concept of salvation The Near Eastern religions, notably Islam and Christianity, seek to attain eternal life in the Indian religions one actually seeks liberation from the eternal life that is threatening the individual in the form of an unending series of rebirths Cf B C Zaehner, *Concordant Discord* (Oxford 1970) p 439 "The only common ground (of Indian and Semitic religions) is that the function of religion is to provide release there is no agreement at all as to what it is that man must be released from The great religions are talking at cross purposes "

But we must not really blame al-Bīrūnī for not having attended to such subtleties When he makes the Indian religion an object of serious and impartial consideration and finds in it similarities with other religious and philosophical systems that were known to him, he only follows the Islamic tradition of the philosophers who studied Aristotle and the Neo-Platonists and even allowed their doctrines a paramount position in speculative theology Islam was not overthrown by Aristotle, and there is no reason to be afraid that anyone should lose his faith when reading about the opinions of the Hindus Al-Bīrūnī declares in the very beginning that his book is not a polemical one "I shall not produce the arguments of our antagonists in order to refute such of them as I believe to be in the wrong My book is nothing but a simple historic record of facts" (I 7) It seems that al-Bīrūnī is exceptionally careful when speaking about religion He seems to try to avoid giving his readers the impression that everything the Hindus say is just mad raving or impiety

Al-Bīrūnī only begins to criticise the Indian religion more severely when he comes to matters of science Of course, he is able on several occasions to point out the superiority of Islamic science over Indian science in matters of pure research But he seldom criticises the Hindus as sharply as in chapter LIX where he treats the Hindu doctrine of eclipses "Their astronomers know the real cause of solar eclipses, viz , that the moon comes between the sun and the earth, but at the same time they have to pay lip-service to the doctrine of the Puranas, viz , that the moon is above the sun But look, for instance, at Brahmagupta, who is certainly the most distinguished of their astronomers, for as he was one of the Brahmans who read in their Puranas that the sun is lower than the moon, and who therefore require a head biting the sun in order that he should be eclipsed, he shirks the truth and lends his support to imposture, if he did not—and this we think by no means impossible—from intense disgust at them, speak as he spoke simply in order to mock at them " (II, p 110) When speaking about the shape of heaven and earth (I, p 263), he congratulates the Muslims on the account that "the sentences of the Qur'ān on these and other subjects necessary for man to know are not such as to require a strained interpretation in order to become positive certainties in the minds of the hearers, and the same may be said regarding the holy codes revealed before the Qur'ān The sentences of the Qur'ān on the subjects necessary for man to know are in perfect harmony with the other religious codes, and at the same time they are perfectly clear, without any ambiguity Besides, the Qur'ān does not contain questions which have for ever been subjects of controversy, nor such questions the solution of which has always been despaired of , e g., questions similar to certain puzzles of chronology "

Al-Bīrūnī touches here again on a significant difference between Muslim and Indian thought or rather the difference between their respective Holy Books When compared with Indian books, the Qur'ān dispenses almost entirely with mythology and is content with a simple doctrine of God and revelation

As such it leaves ample room for free scientific research Indians, on the contrary, are inclined to express things with myths Al-Bīrūnī is reasonably patient with these myths as long as they are used to illustrate points of religion But as soon as they interfere in the description of the visible world, he becomes irritated In Chapter XXI (I, p 236) he quotes the commentator of the book of *Pat njali* on the subject of the dimension of the world and his enumeration of several mythical earths, and then bursts out "We on our part found it already troublesome to enumerate all the seven seas, together with the seven earths, and now this author thinks he can make the subject more easy and pleasant to us by inventing some more earths below those already enumerated by ourselves!"

Al-Bīrūnī has also drawn attention to a point which later European students of Indian culture have repeatedly stressed the lack in Indian culture of historical writing and reliable historical tradition "Unfortunately the Hindus do not pay much attention to the historical order of things, they are very careless in relating the chronological succession of their kings, and when they are pressed for information and are at a loss, not knowing what to say, they invariably take to tale-telling" (II, 11)

Despite all shortcomings of Indian science and all the obstacles that stood in his way when he tried to penetrate its secrets, al-Bīrūnī clearly derived great satisfaction from his studies He must have been one of those people whose greatest delight is the solving puzzles, regardless of whether the solution has any practical value or not Otherwise we cannot understand how he could devote at least ten years of his life to studying the Indian culture But besides this personal satisfaction, he had a passionate interest in finding the Truth And still more he did not only want to find the truth for himself, he also thought it his duty to communicate it to others His preface to the book on India is actually a fervent hymn to the praise of truth and truthfulness, although written in al-Bīrūnī's dry and concise prose style that lacks almost all the traditional embellishments of Arabic writing "Eye-witness is better than hearsay", as the proverb says For past events, however, we have to rely on writing, which is a form of hearsay, but has the merit of preserving history that otherwise might be lost Unfortunately too many writers tell lies—for different reasons But—"That man only is praiseworthy who shrinks from a lie and always adheres to truth, enjoying credit even among liars, not to mention others" (I, p 4) "Now as justice (i e being just) is a quality liked and coveted for its own self, for its intrinsic beauty, the same applies to truthfulness, except perhaps in the case of such people as never tasted how sweet it is, or know the truth, but deliberately shun it, like a notorious liar who once was asked if he had ever spoken the truth, and gave the answer "If I were not afraid to speak the truth, I should say, no " Al-Bīrūnī then states that many people who write about other religions and sects and try to refute them, often misrepresent the views of the opponent Such will not be his method "I have written this book on the doctrines of the Hindus, never making any unfounded imputations against those, our religious

antagonists, and at the same time not considering it inconsistent with my duties as a Muslim to quote their own words at full length when I thought they would contribute to elucidate a subject If the contents of these quotations happen to be utterly heathenish, and the followers of the truth, i e the Muslims, find them objectionable, we can only say that such is the belief of the Hindus, and that they themselves are best qualified to defend it" (I, p 7)

The interesting point about this quotation is, that the Truth (*al-haqq* is there used as a synonym of Islam, of course, according to established usage This circumstance also explains the confidence of al-Bīrūnī that the facts produced by him will not harm the religion True facts can only serve to bring out more clearly the truth of Islam, whereas lies or distortion would be harmful to it The same sentiment is expressed in the closing sentences of the book "We think now that what we have related in this book will be sufficient for any one who wants to converse with the Hindus, and to discuss with them questions of religion, science, or literature, on the very basis of their own civilisation Therefore, we shall finish this treatise, which has already, both by its length and breadth, wearied the reader We ask God to pardon us for every statement of ours which is not true We ask Him to help us that we may adhere to that which yields Him satisfaction We ask Him to lead us to a proper insight into the nature of that which is false and idle, that we may sift it so as to distinguish the chaff from the wheat" (II, 246)

It also emerges from these concluding words that al-Bīrūnī did not consider his own book as something final or comprising everything that a Muslim need to know about the doctrines and customs of the Hindus On the contrary he expects that from now on a real encounter of cultures should begin He seems to hope that many of his contemporaries should converse with the Hindus and discuss with them questions of religion, science, or literature, "on the very basis of their own civilisation" Al-Bīrūnī is here very far ahead of his time indeed because even in our times, when much has been spoken and written about the encounter of civilisations and dialogue between the adherents of different faiths, deplorably little has been achieved in these difficult endeavours

AL-BĪRŪNĪ'S METHODOLOGY IN INDIA

MOHAMMAD ASLAM

NEITHER love for Hindus, nor malice towards them incited al-Bīrūnī to inquire into their thought, religion and literature Passions of love and hate definitely play their part and they do poison the vision of scholars These passions continue to act as the guiding force throughout their studies and while collecting the material they become instrumental, and "assist" the historian in satisfying his ego If the people are under discussion, either they become descendants of God or disciples of Devil, if a place is being traced, it comes out either as the source of piety or as the centre of evils and so on and so forth For a nationalist and a patriot, these extremes are undoubtedly milestones in the history of national literature but a lover of knowledge and truth would render these accounts as mere deviation from truth and distortion of facts

Al-Bīrūnī being a Muslim, wrote this book about the Hindus who were not the people of the Book, but those who were infidels, pagans and idolaters in the language of his books, whose customs were abominable for him, whose way of living was disliked by him and whose day to day activities seemed to him deliberately made opposite to his own But al-Bīrūnī was a lover of knowledge, a champion of truth and whenever he wrote about Hindus he was dominated by the passions of truth and accuracy and not those of love and hatred

In order to illustrate our thesis, we shall have to see as to why did he write this book In other words, if we are in a position to determine his motive, his approach and method would be traced because motives determine methods If the motive is not honest, the method cannot be accurate because in order to fulfil the former the latter must be harmonious with it Al-Bīrūnī has explained the circumstances which made this work to be done During a discussion with his master Abū Sahl on the authenticity of the religious accounts written by non-believers, some one present there referred to the religion and philosophy of the Hindus Thereupon al-Bīrūnī drew their attention to the fact that "everything which exists on this subject in our literature is second hand information which one has copied from the other, a farrago of materials never sifted by the sieve of critical examination" (*Al-Beruni's India*, Vol I, page 8). Then he praised the

work of Abū al-'Abbās al-Irānshahrī but was sorry to find that "when he came in his book to speak of the Hindus and the Buddhists, his arrow missed the mark" (*Ibid* p 80) His master, after finding truth in his statement asked him to write down whatever he knew about the Hindus, "as a help to those who want to discuss religious questions with them, and as a repertory of information to those who want to associate with them" (*Ibid*, p 9)

Thus it was only out of love for accuracy and truth based on first hand information that the book came to be written Dr Sachau's contention that since the author and his countrymen had suffered from oppressors, that community of mishaps inspired him with sympathy (*Ibid*, p XXI) for them, seems imaginative

The second thing which determines method is the collection of material Al-Bīrūnī has very frankly admitted the problems he faced in this regard These difficulties were due to the gulf between the two societies, difference of language, religious prejudices of the Hindus, the radical difference of manners and customs Moreover as he says the Hindus were self-conceited and this gulf had been widened by the Muslim invasions of India (*Ibid*, pp 19—26) The last cause stated by al-Bīrūnī, i e, the Muslim invasions of India has again misled Sachau to conclude that al-Bīrūnī criticized Maḥmūd's invasion of India due to his personal bias whereas in fact the author has also discussed the invasion of Muḥammad bin Qāsim before discussing Maḥmūd's invasion and that too as one of the causes which are responsible for the lack of mutual understanding between the two societies He has based his book on the material collected from all possible sources which were accessible His sources were as follows

1 Primary sources of Hindu religion, mythology and philosophy about which he says "I do not spare either trouble or money in collecting Sanskrit books from places where I supposed they were likely to be found, and in procuring for myself, even from the very remote places, Hindu scholars who understand them and are able to teach me" (Vol I, p 28) It is a fact that he did not study all the sources and he is aware of it He says, "It has never fallen to my lot in my own doings and goings to be perfectly independent, nor to be invested with sufficient power to dispose and to order as I thought best" (p 29)

2 Secondary sources, i e, translations of Sanskrit books by Arabs and Persians ;

3 His travels and observations ;

4 His associations with the Hindus ,

5 His conversation and interviews with Hindu Brahmans, Jogis etc.

Al-Bīrūnī knew the causes of the corruption of texts of documents and his criticism of the documents makes an important feature of his methodology In the preface of his book he wrote

1 "Hearsay does not equal eye witness",

2 "Written tradition is the most preferable",

3 "The tradition regarding an event which in itself does not contradict either logical or physical laws will invariably depend for its character as true or false upon the character of the reporters This statement indicate the following facts

(i) Al-Bīrūnī never believed in hearsay unless he would see it,

(ii) He would prefer written accounts and that too only when they do not contradict logic or the laws of physical sciences (*Ibid*, p 2)

After that he wrote about the liars and the motives behind their falsehood He says that some liars tell a lie in order to further their own interests, interests of their family or nation, others tell lies due to love or hatred towards the parts being discussed, others due to cowardice or greed due to their character and due to ignorance (*Ibid*, p 4) The criticism of the reporters is perhaps due to his study of traditions After criticizing liars he has praised the truth It is equally important to know that al-Bīrūnī wrote this book with the brain of a scientist whose observation does not leave any stone unturned and who is always dependent upon his observations Apart from his religious and moral approach, al-Bīrūnī, as Dr. Sachau says, was a physical scholar and had published works on most departments of natural sciences, optics, mechanics, mineralogy, geology and chemistry and he "wants to sift the wheat from the chaff, and he will discard everything that militates against the laws of nature and of reason (p XXXIII) Though he himself was not well equipped with the correct knowledge of Sanskrit he "criticizes manuscript tradition like a modern philologist He sometimes supposes the text to be corrupt, and inquires into the cause of the corruption, he discusses various readings, and proposes amendments His criticism like any modern historiographer falls into two categories, i e, External Criticism and Internal Criticism He guesses at *lacuna*, criticises different translations, and complains of the carelessness and ignorance of the copyists About his Indian sources he says. "Indian scribes are careless, and do not take pains to produce correct and well-collected copies In consequence, the highest results of the author's mental development are lost by their negligence, and his book becomes already in the first or second copy so full of faults, that the text appears as something entirely new" (p 21)

Again while discussing the weights and measures he refers to an Arabic book translation He says "the Arabic copy seems to be corrupt, like all other books of this kind which I know. Such corruption must of necessity occur in our Arabic

writing, more particularly at a period like ours, when people care so little about the correctness of what they copy" (*Ibid*, p 218) After discussing shortcomings and contradictions in the books he says, "Such are the results when people, instead of translating, indulge in wild conjecture and mingle together different theories in an uncritical manner" (*Ibid*, p 220)

In his discussion on planets and stars, al-Bīrūnī has also criticised Brahmagupta's method but well aware of the mistakes in the manuscript, he says, "For such mistakes as occur in this computation, the author, Brahmagupta, is not to be held responsible, but we rather suspect that the fault lies with the manuscript" (p 106, Vol II)

But like a careful judge of manuscripts, he has not tried to reconstruct the text of manuscript and says, "We, however, cannot go beyond the text we have at our disposal, as we do not know how it may be in a correct copy (*Ibid*, p 106, Vol II) It means that instead of poking his nose, he has left the door open for the next researcher by pointing out the mistakes which he could not remove

He does not believe in whatever is reported to him While discussing the cycle of year, with some people of Kannawj he says, "When I heard, among these pretended names of the cycle of years, names of nations, trees, and mountains, I conceived a suspicion of my reporters, I used great care in examining every single one of them in repeating the same questions at different times, in a different order and context, but what different answers did I get ! God is all wise" (*Ibid*, p 174, Vol II)

While quoting from *Patanjali*, al-Bīrūnī criticizes its commentator by saying "We on our part found it already troublesome to enumerate all the seven seas, together with the seven earths, and now this author thinks he can make the subject more easy and pleasant to us by inventing some more earths below those already enumerated by ourselves" (*Ibid*, p 318) On finding faults in the copies of *Vishnu Purana*, he says "Such is the custom of the copyists and scribes in every nation, and I cannot declare the students of the *Puranas* to be free from it, for they are not men of exact learning" (*Ibid*, p 320)

Al-Bīrūnī while criticizing the contents of his sources also criticizes their language and construction He is of the view that the Hindus like to compose in verses and that "they do not want prose compositions, although it is much easier to understand them" (*Ibid*, p 184) and that they have become rather unintelligible since the metrical form entails a constrained, affected style (*Ibid*, p 185)

He is also deadly against the verbosity of the language The copiousness of the language according to him confuses the reader and he calls it "one of

the greatest faults of the language" (p 306) Though a child of the time which produced literary figures like Firdawsī and 'Unṣurī, he believes in simple and straightforward language either because he faced difficulties or because he did not like the style About the task of language, he says, "the task of language is to give a name to everything in creation and to its effects, a name based on general consent, so that everybody, when hearing this name pronounced by another man, understands what he means" (p 306) He condemns this style as mere nonsense, as a means of keeping people in the dark, and throwing an air of mystery about the subject (p 307) He is also aware of the fact that with the passage of time the language of the people changes and that the names change their pronunciation while being uttered by a foreigner (p 402)

After discussing the criticism, we try to see the features of his historical exposition The author has divided most of his text into four parts

(a) The first part deals with the problem he is going to discuss,

(b) The second part what the Hindus think about that,

(c) The third part consists of parallels if, at all, they are there in the Greek or Muslim thought ,

(d) And in the fourth part he gives his own conclusion.

Thus the book is not merely a scissors and paste work

Al-Bīrūnī, like a true logician has avoided to convert the book into a debate between Muslims and Hindus He says "This book is not a polemical one I shall not produce the arguments of our antagonists in order to refute such of them as I believe to be in the wrong My book is nothing but a simple historic record of facts I shall place before the reader the theories of the Hindus exactly as they are" (p 9) In order to fulfil this pledge al-Bīrūnī has extensively quoted from his sources without "making any unfounded imputations" against them Regarding the attitude of the Muslims towards Hindu doctrines, he is least concerned and says, "If the contents of those quotations happen to be utterly heathenish, and the followers of the truth, i e the Muslims, find them objectionable, we can only say that such is the belief of the Hindus, and that they themselves are best qualified to defend it" (p 9) His comparative study of Greek, Ṣūfī, Hindu and Christian notions and to find parallels presents a classic instance of the Muslim literary movement which aimed at seeking knowledge and truth irrespective of the political and religious antagonism of the time During the time of early 'Abbasids, Muslims had developed their philosophy and political thought which also influenced the mind of our author His criticism falls only where he deems it essential and has kept in mind the fact that sometimes it is very difficult to find corresponding words in two different languages especially regarding terminology and at such places he uses the Sanskrit words, of course "explaining and translating them as accurately as possible" (p 31).

While discussing the religious philosophy of Brahmans, al-Bīrūnī has very clearly differentiated between the religious beliefs and practices of the educated and the uneducated people and has avoided the danger of the two being confused with each other Generalizations and reasoning also make an indispensable part of his work Like a humanist he has tried to seek the origins of certain bad institutions, for instance about idolatory he says "The first cause of idolatory was the desire of commemorating the dead and of consoling the living, but on this basis it has developed, and has finally become a foul and pernicious abuse" (p 168, I) He has illustrated his thesis from Greek and Hindu mythology His attacks on pre-Islam Arabs have resulted in inciting Dr Sachau to believe that "his recognition of Islam is not without a tacit reserve He dares not attack Islam, but he attacks the Arabs" (p XXIII) Here a learned scholar like Sachau is confusing the institution with the people To condemn the pre-Islam Arabs cannot amount to the criticism of *Islam*, and al-Bīrūnī, like an anthropologist, is comparing the rural and urban cultures of the Arabs and the Iranians and at the same time is discovering common things in the pre-Muslim Arabia and Hindus These remarks cannot be regarded as anti-Islamic rather they portray the parallels amongst the cultures in their infancy The book is certainly not ذالک الکتاب لا ریب فیه (*Dhālik al-Kitāb lārayb Fīh*) It has its shortcomings too

(i) The author has not touched many of the most important sources,

(ii) The author has not given any account of the political history of India,

(iii) The book does not represent a detailed picture of India,

(iv) The classification of his material is not balanced Sometimes he devotes long chapters to minor things whereas certain important things are left either untouched or partly dealt with,

(v) His information about Jainism and Buddhism is scanty and second hand and he has depended upon the biased information given by the Brahmans

About himself, al-Bīrūnī says that he was alone in his field and that "our fellow-believers in these countries are not acquainted with the Hindu methods of astrology, and have never had an opportunity of studying an Indian book on the subject" (p 283, Vol II) This is too sweeping a statement because the Muslims had started taking interest in the Indian affairs from the second century Hijrah In 154 Hij *Sadhanant*, a book on astronomy had been translated into Arabic. The pandit who took the book with him to the Caliph of Baghdad produced two disciples, i e Ya'qūb bin Ṭāriq and Ibrāhīm Fazādī Ma'mūn's reign produced astronomers like Khwārizmī who combined Iranian, Greek and Indian principles and an observatory was also established He also wrote a book known as (*al-Sind Hind al-Ṣaghīr*) السند هند الصغير Before al-Bīrūnī, Ḥasan bin Ṣabāh, Ḥasan bin Khasīb, Faḍal bin Hātim Nawrezī, and Aḥmad bin 'Abd Allah had written on Indian affairs

If we look at certain other facts even here al-Bīrūnī stands justified Most of the sources were not made available to him He as he says, was not given enough facilities Moreover the way he did this job was undoubtedly without any parallel at least in his time

Dr Sachau, while evaluating *Indica* says that the author had "nothing in common with the Muḥammad Ghāzī who wanted to convert the Hindus or to kill them, and his book scarcely reminds the reader of the incessant war between Islam and India, during which it had been prepared, and by which the possibility of writing such a book had first been given It is like a magic island of quiet, impartial research in the midst of a world of clashing swords, burning towns, and plundered temples "The object which the author had in view, and never for a moment lost sight of, was to afford the necessary information and training to "any one (in Islam) who wants to converse with the Hindus, and to discuss with them questions of religion, science, or literature or the very basis of their own civilization" But as he later on admits, al-Bīrūnī "continues a literary movement which at his time had already gone on for centuries" but he surpassed his predecessors by going back upon the original Sanskrit sources, trying to check his Pandits by whatever Sanskrit he had contrived to learn, by making new and more accurate translations, and by his conscientious method of testing data of the Indian astronomers by calculation His work represents a scientific renaissance in comparison with the aspirations of the scholars working in Baghdād under the first 'Abbasid Caliphs

Al-Bīrūnī's method of writing *Indica* gives us an insight into the interest with which he wrote the book The pains he took in writing about those who were not his co-religionists, rather regarded as foes by the dynasty under which he served, enlighten the mind of modern writers who under the growing influence of politics let their views slip under the sway of pride and prejudice and fail to see anything worth mentioning in their opponents The Muslims were at war with the Hindus, humiliating their gods and destroying their temples but one of their intellectual monarchs was learning Sanskrit, reading Hindu books, folding his hands before the Pandits in order to read the minds of the nation and to expose it to his people who were going to share one thousand years of love and hatred with them Giving them a true picture of their mental accomplishments, their religious doctrines and their day to day life [1]

On the other hand, he was trying to find out that in certain cases, the streams of Muslim, Hindu and Greek thoughts had the same waters, only the degree of purity and the speed of flow differed Was it not an international outlook, an effort to remove the misunderstandings and to bring humanity closer and closer?

AL-BĪRŪNĪ ON HINDU RELIGIOUS THOUGHT

BASHIR AHMED DAR

VERY soon after the establishment of Islam in Arabia and surrounding areas, Muslims established contacts with the people of the Sub-Continent although for a long time these contacts remained political or diplomatic Probably it was during the 'Abbasid period that contacts on the cultural level began to be developed Muslims became familiar with Hindu medicine, Hindu astronomy and mathematics, the three branches of science that have great practical potentialities

As commercial contacts developed, an increasing number of people came to visit the Sub-Continent to explore the land, to see the people, to assess the possibilities of import and export, to determine geographical location of different cities, to navigate the seas around the land There were hosts of travellers who helped the Muslim traders and businessmen back at home in giving the much-needed information about the country

But when Bīrūnī came to the Sub-Continent his object was quite different He wanted to study the people inhabiting this ancient land of scholars and rishis, with whom he probably had racial affinities though ideologically he stood on the opposite pole It was their cultural achievements which interested him most and therefore he devoted his attention, mostly, to their religion, philosophy, literature, folklore and other sciences that they cultivated It was a spiritual pilgrimage which enabled him to see the truth with his own eyes He met and talked with all kinds of people, read whatever he could lay his hands upon, conversed with different scholars, learning and sometimes teaching them In spite of political upheavals as a result of Maḥmūd's constant invasions and extermination of the Hindu kingdoms of the North, Bīrūnī seems to be unaffected, emotionally Hindus must have been perturbed by the unsuccessful attempts of their armies against the invaders and the consequent destruction of life and property And yet Bīrūnī displays, nowhere, any sign of superiority merely because he belonged to a conquering race nor is there any malice in his heart against the Hindus because they had been defeated in the battlefield It goes to his credit, as a scientist, that his interest in the people and their cultural

achievements remained totally above prejudices of all sorts. Whatever account he gives of their religion, it is exclusively on the basis of their own writings or what he had heard from scholars who had authority to speak on their behalf

That this attitude of scientific objectivity was the result of his Islamic faith and Muslim cultural environment, is evident from what he writes in the introductory chapter of his *Kitāb al-Hind* He explains how he tried to save himself from untruth and falsehood, by analysing psychological motives—hatred, love, ignorance, etc —which often lead one to speak or believe in falsehood Through God's mercy, he says, he was afflicted by none of these He says, "That man alone is praiseworthy who shrinks from a lie and always adheres to the truth, enjoying credit even among liars, not to mention others " It has been said in the Qur'ān, "Speak the truth, even if it were against yourself" (iv, 134)

Dr Sachau who should be complimented for introducing Bīrūnī to the world of scholarship and who exuberantly praises him for his objectivity, unfortunately, shows little of this himself and never misses an opportunity to throw mud on Islam and Muslims He raises the question how is it possible that so bigoted a people as Muslims are, could write and still stranger, read with equanimity, about the religion and culture of a people politically their antagonists in such a sympathetic and unbiassed way as Bīrūnī has done? One reason that so easily and yet naively comes to his mind is that perhaps Bīrūnī is not a Muslim in his heart and that his allegiance to Islam is merely a fake He says that Bīrūnī's "recognition of Islam is not without a tacit reserve He dares not attack Islam but he attacks the Arabs" (p xix of Vol I) This insinuation of his is totally unjustified Perhaps Dr Sachau is unaware that the Qur'ān itself uses very strong language against the Arabs (for instance, ix, 98)

Then he asserts with confidence that Bīrūnī's study of Hinduism, so sympathetically done must have been a source of great embarrassment to him But when he meets with no historical record of any Muslim protests against Bīrūnī, he says, "There can be scarcely any doubt that Muslims of later times would have found fault with him for going to such length in his interest for these heathenish doctrines" Then he adds, "It is a singular fact that al-Bīrūnī wrote under a prince who burned and impaled the Qarmatians" (p xviii)

But Bīrūnī's faithful and unbiassed account stares him in the face He is forced to the conclusion that "there was a large margin for liberty of religious thought under the rule of Maḥmūd and his immediate successors" (See notes to p 31 in ii, p 269) It so appears that Dr Sachau would not bring himself round to believing that Islam, as a religion, could be so tolerant so he divides Muslim history, quite arbitrarily, into that before Ghazālī and that after Ghazālī and puts the stigma of bigotry and intolerance on Islam as formulated by Ghazālī (ii, p 269)

He is so sure that had Bīrūnī written under other circumstances and in other periods of Muslim history, such a work might have proved fatal to its author As it is, it shows, he admits so reluctantly, that "the religious policy of King Maḥmūd, the great destroyer of Hindu temples and idols, under whom Bīrūnī wrote, must have been so liberal as to be rarely met with in the annals of Islam" (ii, page 250)

II

About half a century before *Kitāb al-Hind* was written (in 421-2/1031), Ibn Nadīm, in his famous compilation, *al Fihrist* (written in 377/987), states that he had read somewhere about a book dealing with *Milal al-Hind wa adyanuha*, (people and religions of India) which was prepared by some one whom Barmakid Yaḥyā b Khālid had sent to India for this purpose But the details given in *Fihrist* about religious faiths of India is hardly of any significance When Bīrūnī undertook to write on this subject, he had no reliable material before him As he writes in the preface to the book, "everything which exists on the subject in our literature is second-hand information which one has copied from the other farrago of materials never sifted by the sieve of critical examination" (i, 6)

The only exception in this case is the work compiled by one Abū al-'Abbās Irānshahrī who, as Bīrūnī states, tried his best to present the doctrines of Jews and Christians on the basis of what the followers of these religions had themselves written about their faiths But unfortunately, when he comes to deal with Hindu religion, Bīrūnī laments, his account is most trivial, for most probably he neither had any standard and authoritative book before him nor had he met any scholar of these faiths

It was to fill in this gap in the world of scholarship, that Bīrūnī undertook the responsibility, at the request of one of his friends, to write an authentic aceount of the religious thought of the Hindus As regards his procedure, he states that "I shall never make any unfounded imputations against those, our religious antagonists, and at the same time not considering it inconsistent with my duties as a Muslim to quote their own words at full length when I thought they would contribute to elucidating the subject My book is nothing but a simple historical record of facts I shall place before the readers the theoies of the Hindus exactly as they are " (i, p 7)

Before writing this book, Bīrūnī had already translated into Arabic two Sanskrit works One which Bīrūnī calls *Samkhya*, is most probably the *Bhashya* of Gaudapada, the teacher of Sankaracharya The other which Bīrūnī calls *Patanjali*, is a popular book of theosophy, explaining the doctrine of the Yoga, a theistic philosophy propounded by Patanjali (See Dr Sachau's Notes to p 27 and to p 30 in ii, 263-4, 266-267)

III

Bīrūnī states quite unequivocally that the Hindus believe in the Unity of God While explaining the significance of the symbol OM, he says that it is not composed of letters but is only an image, devised to represent "a confession of the Unity of God" (i, p 173) They believe in a God who is eternal, unique, beyond all likenesses By His essence, He knows from all eternity, He is absolute good, He often speaks to the people "It was He who spoke to Brahman, and to others of the first beings in different ways On the one He bestowed a book, for the other He opened a door, a means of communication with Him, a third one He inspired so that he obtained by cognition what God bestowed on him" (i, p 28)

It is He who spoke to men through the *Veda* He is hidden to the senses and yet the soul perceives Him, and thought comprehends His qualities He does not stand in need of any human action, He gives recompense either in form of blissful repose which is longed for or a troubled existence which is feared and dreaded

The god described here is the God of all theistic religions He is not an impersonal entity, a nirguna Brahman of Shankara, or Absolute Being, i,e *Wajūd-i-Mutlaq* of Ibn al-'Arabī Bīrūnī adds that the Hindus call him Ishwara, i e , self-sufficing, beneficent who gives without receiving It should be clearly distinguished from Shankara's conception of Ishwara which is the product of 'maya linking with indeterminate Brahman, who is neither real like Brahman nor unreal as the flower of the sky' (See my article "Pantheism and Theism in India" in the Quarterly IQBAL for July 1958, pp 68-69)

Bīrūnī is careful to point out that this belief of the Hindus shoud be distinguished from that of the uneducated masses, whose ideas are, as he puts it, simply abominable Such errors and falsehood, he adds, can be observed among common people of other societies, Muslims included The reason for these deviations, he rightly points out, lies in the interpretation of the revealed texts Some Hindu scholars, in order to emphasise God's absolute dissimilarity with any material object, call God a point In the hands of uneducated people, it let to determining the exact magnitude of God's body It was in this context that some people said that God is twelve fingers long and ten fingers broad The same phenomenon, as we know, occurred among Muslims some of whom asserted strange things about God merely because the Qur'ān mentions hands, sight and hearing of God Ash'arī in his *Maqālāt al-Islāmiyyīn* mentions the names of several Muslim theologians who asserted that God has body and some went to the length of giving its exact or nearly exact magnitude (See its Urdu translation, Institute of Islamic Culture, Lahore, 1968, pp 227-234)

COSMOLOGY

Hindus believe that this world is a unity and everything, matter included, is impregnated with divine spirit In support of this theory of Pan-Psychism Bīrūnī quotes from the *Gita* a passage which says that the earth, water, fire and wind were created by Vishnu and that he made himself the heart of every single being

The universe is composed of 25 elements, the totality of which is called *tattva* The first is soul, called *purusha*, male It is the element of life The second, abstract and shapeless matter, Greek *hyle*, rendered into Arabic as *hayla*, which is only potential, non-being When it becomes actual and acquires shape, it becomes *prakriti* These two, *purusha* and *prakriti*, are the basic elements of the universe, like Yin-Yang polarity in the Chinese thought

Hindus believe that there are five elements of matter, viz, heaven, wind, fire, water and earth, called *mahabhuta* When these elements combine, the result is animal Plants are a species of animals just as Plato asserted that plants are endowed with sense There are five senses, called *indriyani*, viz, hearing, seeing, smelling, tasting and touching The role of will, called *manas*, is specially emphasised It is this will which, according to the Hindus, directs the senses in the exercise of their various functions

BODY AND SOUL

Soul is like rain water which comes down from heaven, always the same and of the same nature It is gathered in vessels of different size, water assumes different shapes Soul is one, multiplicity is due to matter, body The soul is to body as the rider is to carriage, attended by senses, who drive the carriage according to the rider's intentions The soul, on its part, is guided by intelligence with which it is inspired by God

SOUL'S DESTINY

It is characteristic of Hindu thought that in spite of manifold differences in outlook on various problems of religious thought, all Hindu thinkers are unanimous in their view about the ultimate destiny of human soul "As the words of confession there is no god but God and Muḥammad is His Prophet, is the shibboleth of Islam, the Trinity that of Christianity, and the institute of Sabbath that of Judaism, so metempsychosis is the shibboleth of the Hindu religion Therefore he who does not believe in it does not belong to them" (1, p 50)

Metempsychosis is an intellectual attempt to explain soul's eternal craving for knowledge of things around There is a limitless, rather almost infinite, storehouse of objects and experiences in the universe One life span is hardly

sufficient to explore it in all the details The human soul enters one body and tries to satisfy its craving After accumulating as much knowledge as it can, when the body, the vehicle through which it communicates and receives, decays, the soul occupies another body, fresh and vigorous, and once again starts on the search for knowledge of things, both mundane and divine

This migration, as Bīrūnī states, begins from low stages and rises to higher and higher ones He rules out the other possibility, viz, migration from higher to lower stages It will end when the object of the soul is attained, when it learns what it did not know before, gets insight " into the nobility of its own being and its independent existence, its knowing that it can dispense with matter after it has become acquainted with the mean nature of matter and the instability of its shapes, and with the truth of the tales about its delights Then the soul turns away from matter, the connecting links are broken, the union is dissolved (Then) the soul returns to its home, carrying with itself as much of the bliss of knowledge as sesame develops grains and blossoms, afterwards never separating from its oil" (i, 51)

Apparently, this account of metempsychosis given by Bīrūnī seems to be free from the cyclic view of life and its destiny But if we study at least one of the quotations given by him, we see that it involves the following two ideas

(i) The world of matter is basically evil and hence soul's initial emergence in the world is not a challenge to its limitless energies to overpower all obstacles and thus to gain self-possession, but a sort of imprisonment

(ii) It is based on the cyclic concept of life in which one meets with the same sort of experiences It is implied in the story which Bīrūnī quotes from some book At the time of death, a king asked the people to burn his body at a spot where never before had a dead body been burned When at last the people found one, Vasudeva spoke unto them "this king has been burned on this identical rock already many times" (i, 53) Nietzsche's well-known theory of Eternal Recurrence is only an echo of this theory of metempsychosis, which robs life of all originality and creative efforts

There is a paradise called *svarloka* and hell called *nagaloka*, the world of snakes For those who do not deserve to enter paradise and are not sunk so low as to be sent to hell, there is another world called *tiryagloka*, the irrational world of plants and animals The soul has to wander in this *loka* until it reaches the state of human beings and then it enters paradise The Hindu thinkers are clear on two points First, when man enters paradise or hell, it is only his soul that does it; bodies waste away and have no access to that region Secondly, life in paradise and hell is only for a limited period in proportion to the quantity of deeds done in his life "Not one action of man", says the Sacred Book

of the Hindus, "shall be lost, not even the last of all, it shall be brought to his account after his good and bad actions have been balanced against each other" (i, 59-62) These beautiful words remind one of the several verses of the Qur'ān, specially the xcix, 7-8 After having received the reward of his actions, he again returns to a bodily appearance and human shape in order to be prepared for his future destiny

Hinduism, as depicted by Bīrūnī, is a religion of liberation or salvation It insists that the soul of man when born into this world of matter, is as if imprisoned in an uncongenial atmosphere The cause is ignorance, *maya* So the process of liberation depends upon true knowledge and not work or activity When man is able to attain true knowledge, action ceases and both matter and soul become free by separating from each other This liberation is *Moksha*, i e end of the journey of the soul

What is this state of *Moksha* like? Does the individual succeed, in this state of supreme bliss, in retaining his individuality? According to the Hindus, liberation is union with God which naturally implies submergence of the drop in the ocean of Being and thus the drop ceases to exist In such circumstances, it is anybody's guess whose liberation it would be

According to the common belief among the Hindus, liberation is possible only for the Brahmans and Kshatriyas, for the knowledge of *Vedas* is prohibited to other classes but according to Hindu philosophers liberation is open to all, provided they strive for it

Before I close this summary of Bīrūnī's views about Hindu religious thought, as he learned it during the early decades of the eleventh century of the Christian era, I would like to mention two points One, Bīrūnī feels that the religious thought of the Hindus, in its basic pattern, is allied to Greek and other religions of the world They all hold pure monotheism and worship, in all sincerity, one sole Almighty God, who is deeply concerned with the welfare of mankind and is always ready to guide them towards the right path He is transcendant as well as im manent He speaks to man and listens to his cravings and yet is so unlike everything Polytheism and idol-worship is not a normal expression of their religious consciousness as some people allege, but an aberration, it is not the consequence of exclusively immanent concept of God but the result of dark passions of the crown Bīrūnī has taken great pains to explain how foul and pernicious abuse of idol-worship happened to develop among the Hindus and the Greeks in order to commemorate the dead and console the living (i, 124)

It is true Bīrūnī emphasises differences that divide Hindus and Muslims so overwhelmingly, in the very first chapter But if we study it carefully we shall find that these differences are not with regard to the basic religious approach of the two people—in which, as I said earlier, they are almost alike—but with

regard to the social setting in which they confronted each other on the political plane

Secondly, Bīrūnī introduces the book *Gita* to the readers which he states forms part of Bharta Naturally, it refers to the famous *Bhagavad Gita* It has the unique distinction of presenting a type of religion that is purely theistic, although attempts had been made at different times to incorporate passages which are hardly in consonance with the original trend of the book Bīrūnī has given many quotations from this book in support of different theses But it is strange that many of these, about 35 in number, cannot be traced in the present text of the *Gita* A study of these quotations will be highly rewarding as it will reveal why and how the original text was changed I just give one example In the chapter dealing with how idol-worship started among the Hindus (chapter xi), Bīrūnī gives a quotation from the *Gita* which states that people often offer prayers to intermediary beings, although it is not proper It concludes, "Only that is lasting which is obtained from God alone " (i,122) This passage, if rightly elaborated and understood, implies repudiation of idol-worship But this passage is not to be found in the present text of the *Bhagavad Gita*

AL-BĪRŪNĪ AND GREEK PHILOSOPHY: AN ESSAY IN PHILOSOPHICAL ERUDITION

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AN important aspect of al-Bīrūnī's many-faceted genius is his profound philosophical erudition A non-conventional feature of this erudition, from the standpoint of Islamic philosophy, is his well-known incursions into the domain of Indian philosophical and religious thought, which have hardly a single parallel in the history of Islamic culture [1] But this non-conventionality is offset by his conscious and deliberate attempt to draw parallels between Indian and Greek philosophical and religious ideas This procedure is justified by al-Bīrūnī on the ground of the essential conformity of Indian and Greek doctrines, despite the fact that he credits the Greek philosophers with a certain pre-eminence born of their systematism and their deference for syllogistic reasoning [2]

My principal aim in this paper is to draw attention to his copious references to Greek philosophical ideas and to identify their origins in Arabic or Greek sources In the sequel I will discuss these references and draw certain conclusions from them and underscore their relevance to Islamic philosophy

I will begin with his list of the Seven Sages, which is identical with the most popular list and differs only in one case from the earliest list of the Seven Sages contained in Plato's *Protagoras* (343) [3] Al-Bīrūnī's list consists of Solon of Athens, Bias al-Fārinī (of Priene), Periandros of Corinth, Thales of Miletus, Chilon of Lacedaimon, Pittacus Lesbius of Mitylene, and Cleobulus Laudius (the Lindian) of Rhodes[4] Perhaps the chief interest of this list is that it diverges widely from other Arabic lists, such as the one given in al-Shahrastānī's *al-Milal wa'l-Nihal*, but is identical with Diogenes Laertius' list [5] The well-known history of Greek philosophy written by this third-century author is not referred to in the Arabic sources, as far as I can ascertain, but al-Bīrūnī, as well as his near-contemporary historian of ideas, al-Mubashshir ibn Fātik (d ca 1071) may have drawn on an Arabic source ultimately based upon Laertius' *Lives* [6]

II

Equally noteworthy are al-Bīrūnī's quotations from Plato's major dialogue, the *Timaeus*, which has played a decisive role in the development of cosmological ideas in Islam One of the earliest translators of philosophical texts into Arabic, Yaḥiā ibn al-Biṭriq (eighth century) is credited with the translation of this dialogue, later retranslated or revised by Ḥunayn ibn Isḥāq (d 873) and Yaḥiā ibn'Adī (d 974)[7] In one such quotation, he gives this interesting version of *Timaeus*, 41 A "God said to the (subordinate) gods You are not in yourselves incorruptible, but you will not be corrupted by death, because I have given you through my own will, when I created you, the strongest covenant "[8] He (or his source) interprets the plural gods as denoting the angels, asserting that Plato states in an unidentified passage, that God is singular, not plural, and adds that to them God appears to refer in Greek to whatever is noble, including angels, as well as a species which the translators have rendered obscurely as the stillnesses (al-sakīnāt), (which I identify as the Muses) In support of this view, he quotes John the Grammarian (Philoponus), as saying in his refutation of Proclus (sc *De aeternitae mundi*), that the "Greeks applied the term gods to the visible bodies in heaven (i e the stars), as is the custom of many other nations, but when they reflected on intelligible substances, they reserved that term to them "

III

An obvious point of contact between Greek and Indian thought which al-Bīrūnī does not overlook is the doctrine of metempsychosis, which is to Hinduism, as he puts it, what the Trinity is to Christianity and the confession of God's unity to Islam and the observation of the Sabbath to Judaism In support of this thesis, he quotes the statement of Socrates in the *Phaedo* that upon leaving this world, the soul repairs to Hades and from hence back to this world He also refers to one of the major Platonic arguments in that dialogue for the immortality of the soul, namely that opposites always come into being from opposites, and like Plato draws from it the plausible conclusion that knowledge is nothing but reminiscence.

Al-Bīrūnī's account of the fate of the soul after death is well-documented, but here too it is the Platonic-Pythagorean motif which pre-dominates First, he quotes Abū Ya'qūb al-Sijistānī, the Ismā'īlī author, as saying that the Greeks did not believe that the soul could pass into different species in its second reincarnation, whereas Plato, according to John Philoponus, deemed it possible, following therein the "Pythagorean legends", for the soul of rational beings to pass into those of wild beasts This thesis is reinforced by lengthy experts from the *Phaedo* (called by him *al-Majāmi'*), where Socrates speaks of the prospect of joining worthy and virtuous heroes in Hades Speaking of punishment and reward, Plato is said to have divided the souls of the dead into three groups. (a) those who have led a virtuous life in this world will be consigned to a suitable

place in the underworld, where they will be able to enjoy the company of the blessed, (b) those who still yearn after the body and its pleasures will continue to pass through the endless cycle of birth and rebirth, and (c) those who have committed the grave sins of murder, desecration of temples or extortion will be consigned to Tartaros forever However, those who have repented of these crimes or committed less enormous ones, will be freed after atoning for their crimes to a degree deemed adequate by their victims [10]

IV

Apart from the *Phaedo* and the *Timaeus* upon which al-Bīrūnī draws extensively, mention must be made of another Platonic dialogue, i e the *Laws*, which figures prominently among his Greek sources Thus, in his account of the origin of the laws of mankind, he refers to the statement of the Athenian Stranger at the beginning of the dialogue in which the question is raised whether the authors of these laws are to be identified as angels or human beings The answer of Cleinieas (al-Aqnūsī) is given that these authors are indeed angels, although according to the Cretans it is Zeus himself who is the lawgiver, whereas according to the Spartans, it is Apollo [11]

Another important quotation from the *Laws* is the passage in which Plato refers to the institution of religious festivals by the gods and the healing effect of wine-drinking on the elderly, prescribed by Dionysius as an antidote against the miseries of old age [12] It is in this passage that the term *al-sakīnāt*, which al-Bīrūnī finds baffling, occurs But collation with the original clearly shows that Plato was speaking of the Muses in this context

V

If we draw up now an inventory of al-Bīrūnī's sources for Greek thought, we are struck by the fact that it is predominantly Platonic or Neo-Platonic Apart from a possible reliance on Diogenes Laertius, to which we have referred above, the *Timaeus*, the *Laws*, the *Phaedo* of Plato, the *De aeternitate mundi* of Philoponus and Porphyry's lost *History of Philosophy* are his principal sources Other Greek authors mentioned incidentally in the *India* and elsewhere are Amoonius, Aristotle, Homer and Galen It is significant, however, that with the exception of Abū Ya'qūb al-Sijistānī, the tenth-century Ismā'īlī author, no other Arab author is mentioned, despite the vast wealth of information about Greek philosophy contained in the works of such contemporaries or predecessors of al-Bīrūnī as Abū Sulaymān al-Sijistānī (d 1000), Ibn Hindū (d 1030), Miskawayh (d 1030) and many others Whether al-Bīrūnī wished thereby to asset his independence or confine himself to the primary sources, presumably available to him in Arabic, though no longer extant today, is not clear.

There is, however, one important Muslim philosopher to whom al-Bīrūnī accords a measure of pre-eminence In a well-known inventory of Abū Bakr al-Rāzī's (d 925) treatises, al-Bīrūnī is at great pains to conceal his admiration for this very erudite, if notorious, physician, alchemist and philosopher His account of the life and works of al-Rāzī, who has "attained the highest levels in the art (of alchemy)" and whose perspicuity and brilliance are unquestionable, is described as a "narrative" one, to guard against the charge of adulation to which he had succumbed in his youth "For having read his treatise on Metaphysics," he writes, "where he proclaims his sympathy with the books of Mānī, especially the *Book of Secrets*, I was deluded as others are deluded by white or yellow alloys in alchemy Accordingly I was prompted by youth, or rather the obscurity of truth, to seek those *Secrets* among my friends throughout the countries and lands I remained burning with desire for them for more than forty years, until a letter from Hamadhan reached me in Khwārizm offering me a collection of books . which contained the following Manichaean writings *Pragmateia*, the *Book of Giants*, the *Treasure of the Living*, the *Morning of Certainty*, the *Foundation*, the *Evangel*, the *Shabuhragan*, together with many epistles of Mānī and the *Book of Secrets* I was searching for I was overwhelmed with joy and proceeded at once to summarize the pure gibberish and absolute raving that book contained, so that others afflicted by the disease I was originally afflicted with might be readily healed, as I had been " This was the condition of al-Rāzī himself, according to al-Bīrūnī, for "he was deluded rather than sought to delude", in his anti-religious and pro-Manichaean discourses [13]

It is a tribute to this versatile and enchypoldic author that he is anxious to make this apology for the great Muslim metaphysician who had been slighted and disparaged by so many philosophers and historians of philosophy By giving a short narrative of his life and an inventory of his works, he obviously wished to underscore his stature as a philosopher and physician This is an added measure, we believe, of al-Bīrūnī's impartial search for truth, his vast erudition, his profound philosophical sympathies and his humanity

BIBLIOGRAPHY

1 Al-Bīrūnī himself mentions a little-known author, Abū al-'Abbās al-Irān Shahrī (ninth century), whom he commends for aiming at objectivity in his account of the religious beliefs of the Jews, Christians and Indians See *Alberuni's India*, ed Eduard Sachau, London, 1887, p 4 (Hereafter India)

2 India, pp 4 & 12

3 See F Ueberweg, *History of Philosophy*, New York, 1871, vol I, 76, and George Sarton, *History of Science*, Cambridge Mass, 1959, vol I, 168 Plato excluded Periandros, because he was a tyrant,

4. *India*, pp 15f.

5 See *Lives*, I, 1, 13

6 Aristotle's will given in *al-Fihrist* of Ibn al-Nadīm (d 995) and *'Uyūn al-Anbā'* of Ibn Abī Uṣaybo'ah (d 1270) may be adduced as further evidence of the knowledge of Laertius' *Lives* by Arabic historians of philosophy.

7 See my article, "A Tenth-Century Arabic Interpretation of Plato's Cosmology", in *Journal of History of Philosophy*, VI (1968), pp 15-22 Cf *Galeni compendium Timaei Platonis*, ed p Kraus & R Walzer, London 1951

8 *India* p 17 ان الله قال للالهه :
انكملستم فى انفسكم غير قابلين للفساد اصلاو انما لن تفسدوا
بموت ، انكم (لا نكم I read) نلتم من مشيئتى وقت احداثى لكم اوثق عقد

9 *India*, p 28 Cf Plato, *Phaedo*, 70A

10 *India*, pp 33f Cf Phaedo, 108A and 114B This passage appears to be a verbal translation of the text of the *Phaedo* Since we have no other reference to it in Arabic earlier than al-Bīrūnī, I will give it in full

" وقال (اى سقراط) فى " المحامع " (اى *Phaedo*) : لو لم ارى صائرا الى الالهه (Sic حكما ، و سادة اخيار ، ثم من بعد الى ناس ما توا خير ممن ها هنا ، لكان تركى الحزن على الموت ظلما (*Phaedo* 69D) . وقال فى محلى المثوبه والعقوبة : ان الانسان اذا مات ذهب به دامون (Daimon) وهو من الربانيه ، الى مجمع القضاء ، و يحمله مع المجتمعين فى قائد مأمور الى ايرس (Hades) حتى اذا اقام فيه ما ينبغي من الزمان ادوارا كثيره وطويله (   ) وقد قال طيلا فوس (Telephos) ان طريق ايرس مبسوطه ، قال (اى سقراط) : واما القول لو كانت مبسوطه او واحده لا ستغنى عن القائد فيها (*Ibid* 108A) فاما النفس التى تشتهى الجسد او كان عملها شيئا غير عدل و متشبهه بالانفس القاتله ، هربت من هناك وتحيرت فى كل نوع الى ان يمر عليها ازمنه فيوتى بها ضرورة الى المسكن الذى يشبهها . واما الطاهره فانها تصادف مرافقين وقوادا آلهه وسكن لموضع الذين ينبغى (*Ibid*, 108B) وقال : ومن كان من الموتى متوسط السيره فانهم يركبون على مراكب (مركب Text) معده لهم فى اخارون (Acheron) ، فاذا انتقم منهم ونقوا من الظلم اغتسلوا وقبلوا كرامات ما احسنوا من الصنيع بحسب الاستئهال . واما الذين ارتكبوا الكبائر مثل السرقه من قرابين الالهه او غصب الاموال العظيمه او القتل بظلم وتعمد على خلاف النواميس فانهم يلقون فى طرطاروس (Tartaros) ولا يخرجون منه ابدا . واما الذين ندموا على ذنوبهم مده عمرهم وقصرت اثامهم

عن تلك الدرجة ، وكانت كالا رتكاب من الوالدين وقهرهما بالغضب وقتل خطأ ، فانهم يلقون في طرطاروس سنة كاملة يتعذبون ثم يلقيهم الموج الى موضع بها دون سه حصومهم يسألونهم الاقتصار منهم على القصاص ليمحوا من الشرور ، فان رضوا عنهم والا اعيدوا الى طرطاروس ، ولم يزل ذلك دابهم في العذاب الى ان يرضى حصومهم عنهم . والذين كانت سيرتهم فاضلة ، يتخلصون من هذه المواضع من هذه الارض ويستريحون من المحابس ويسكنون الارض النقية " (*Ibid*, 113 D—114B)

11 *Ibid*, p. 51. Cf *Laws* 1, 624 A & *Alfarabius Compendium Legum*, dit F. Gabrieli, London 1952, p 5

وفي المقالة الاولى من كتاب النواميس لافلاطون ، قال الغريب من اهل اثينة : من تراه كان السبب في وضع النواميس لكم اهو بعض الملائكة (*Laws* God) او بعض الناس قال الاقلوني ، Cleinias : هو بعض الملائكة (*Laws* God) اما بالحقيقة عندنا فزوس (Zeus) ، واما اهل الاقداموتيا ، فانهم يزعمون ان واضع النواميس لهم افوللن (Apollon) ، (*Laws I*, 624 A) .

F Rosenthal has referred to al-Bīrūnī's quotations from Plato, especially the passage from *Laws* 1, 631 B C See "On the knowledge of Plato's Philosophy in the Islamic World", in *Islamic Culture*, XIV (1940), pp 395f He has overlooked, however, the major passages from the *Phaedo*, *Timaeus* and *Laws* discussed in this paper.

12 India, p 51

" وقال الاثيني في المقالة الثانية من هذا الكتاب : لما رحم الالهة جنس البشر من اجل انه مطبوع على التعب هيأوا لهم اعيادا للالهة والسكينات (Muses) ولا فوللن مدبر السكينات ولد يونوسيس (Dionysius) مانح البشر الخمرة دواءً لهم عن عفوصة الشيخوخة ليعودوا فتيانا بالذهول عن الكآبة وانتقال خلق النفس من الشدة الى السلامة " . (*Laws II*, 653 D)

" وقال ايضاً : انهم الهموهم تدابير الرقص والايقاع المستوى الوزن جزاءً على المتاعب وليتعودوا معهم في الاعياد والافراح ولذلك سمّي نوع من انواع الموسيقى في الزمر لصلوات الالهة تسابيح " (*Laws II*, 654 A) .

13 See *Risālah li'l-Bīrūnī fī Fihrist Kutub al-Rāzī* ed P Kraus, Paris, 1936, pp 3f For Arabic titles of Mānī's books, compare Ibn al-Nadīm, *al-Fihrist*, p. 484.

AL-BĪRŪNĪ AND ṢŪFISM

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AL-BĪRŪNĪ is a great scholar in various fields of learning He wrote at a critical period in Indian history when Sultān Maḥmūd of Ghaznah brought about a great political change in the Indo-Gangetic plains He touched upon a variety of subjects, Ṣūfism being one of them

Al-Bīrūnī gives the following explanation about the origin of the word Ṣūfī

"This is also the theory of the ṣūfīs i e the sages, for Ṣūfī means in Greek, 'wisdom' Therefore a philosopher is called *Pailasopa* i e loving wisdom When in Islam persons adopted something like the doctrines of those philosophers, they also adopted their name, but some people did not understand the meaning of the word, and erroneously combined it with the Arabic word ṣuffah, as if the Ṣūfī were identical with the so-called 'Al-aṣṣuffah among the companions of Muḥammad In the later times the word was corrupted by misspelling, so that it was finally taken for a derivation from Ṣūfī, i e the wool of goats Abū al-Fatḥ al-Bustī made a laudable effort to avoid this mistake when he said, "From olden times people have differed as to the meaning of the word Ṣūfī and have thought it a derivative from ṣūf i e wool I, for my part, understand by the word a youth who is ṣāfī i e pure This ṣāfī has become Ṣūfī, and in this form the name of a class of thinkers, the Ṣūfī " [1]

In the above quotation al-Bīrūnī has explained the literal meaning of the word 'Ṣūfī' in three senses First, the "ṣūfīs i e the sages", means, in Greek, 'wisdom' The modern word philosopher is derived from *Pailasopa*, meaning loving wisdom In fact, this sense is of the Greek philosophers It not only influenced al-Bīrūnī but the other philosophers of Islam also The influence from Greek philosophy is deeply imprinted in Islam Discussing its particular feature, R A Nicholson says, "Aristotle, not Plato, is the dominant figure in Muslim philosophy, who was more commonly called, the Greek Master (al-Shaykh al-Yunānī) But since the Arabs gained their first knowledge of Aristotle from his Neo-Platonist commentators, the system with which, they became imbued was that of Porphyry and Proclus Thus the so-called theology of Aristotle, of which an Arabic version appeared in the 9th century, is actually a manual of Neo-Platonism" [2]

To understand the Greek theory, which is also projected by al-Bīrūnī, we further examine it in detail in the light of the Islamic Philosopher's interpretations The term '*hikmah*' appears in several places in the *Holy Qur'ān*, of which perhaps, the well-known verse is, "He giveth the wisdom (Ḥikmah) unto whom He will, and He unto whom wisdom is given, He truly hath received abundant good"[3] It also appears in the Ḥadīth literature in such saying as "the acquisition of '*hikmah*', is incumbent upon thee, verily the good resides in *hikmah*, and "speak not of '*hikmah*' to fools[4] Different Muslim authorities have debated as to what '*hikmah*' means in such verses and sayings Ibn Sīnā, writes "*hikmah* is the perfecting of the human soul through the conceptualisation of things and the judgement of theoretical and practical truths to the measure of human capability"[5] Mullā' Sadrā says, "It is this *ḥikmah* which the Holy Prophet had in mind in his prayer to his Lord when he said 'O Lord, Show us things as they really are[6] In this sense *hikmah* in Arabic or the wisdom (Sophia) in Greek shows the linguistic inter-relationship of the word Ṣūfī as narrated by al-Bīrūnī

Second, al-Bīrūnī criticises by saying that some people did not understand the meaning of the word 'Ṣūfī' and erroneously combined it with the Arabic word 'Ṣuffah', as if the Ṣūfī were identical with the so-called 'al-aṣṣuffah among the companions of Muḥammad

This is the ṣūfī view and is also supported by other Muslims They are of the opinion that the origin of ṣūfism or Islamic mysticism or Taṣawwaf is the teaching of Prophet Muḥammad, and they accept the way of living of the Prophet, and his four companions along with the Aṣḥāb, the followers of Prophet, as the Muslim historians think, sat in the mosque, fervently devoted to the Prophet's doctrines and thus these men of God, called '*Aṣhab-i-ṣafā*, were styled as ṣūfīs They base their theory on two different but fundamental principles, one is the ascetic or esoteric life of the Prophet Muḥammad, and the second is the teaching of Qur'ān While speaking of these people, Abū Nuayn of Iṣfahān said that "They were such people that Janab-e-Haq (God) protects them from the attraction of mortal things and they instead of this mortal and worldly attraction gave themselves to the divine ordinance They were the great examples of those who did not pay any attention to the worldly affairs They had no material goods nor families and even they had no kind of business nor occupation which might keep them away from the remembrance of Allah They did not feel sorry for the worldly things which went from their hands and they enjoyed the things, which they have gained for the other world "[7] But E G Browne rejects this theory and he expressed his views in his book '*A Literary History of Persia*' in the following manner

"This is the prevalent view of Ṣūfīs themselves, of those Mohammadans who are more or less in sympathy with them and though it can hardly commend itself to European scholars, it is by no means so absurd or untenable a hypothesis

as is often assumed in Europe However, a little critical examination of the oldest and most authentic records of the Prophet's life and teachings would warrant us to regard him as a mystic or ascribing to him an esoteric doctrine, it must be avowed without reserve that such is the view taken by the most moderate ṣūfīs and even of such philosophically minded theologians as al-Ghazzālī" [8]

Third, al-Bīrūnī has examined the word Ṣūfī and said in the later time the word was corrupted by misspelling, so that finally it was understood to have connection with ṣūf i e the wool of goats "Abū al-Fatḥ al-Bustī made a laudable effort to avoid this when he said from olden times people have differed as to the meaning of the word Ṣūfī, and have thought it to be a derivative from ṣūf i e wool I, for my part, understand by the word a youth who is ṣāfī i e pure This ṣāfī has become ṣūfī, and in this form the name of a class of thinkers, the Ṣūfī"

The statement shows that al-Bīrūnī did not accept but only appreciated the view stated by Abū al-Fatḥ al-Bustī regarding the literal meaning of the word ṣāf Sarrāj explained that the word Ṣūf by saying that in the early days of Islam, wool garments were frequently worn by ascetics, not only as their distinctive garbs but also as a symbol of their voluntary poverty and renunciation of the world and all its pleasures [9] But this was repudiated by the later Muslim scholars like Abū al-Fatḥ al-Bustī who is aptly right to say that 'I, for my part, understand by the word a youth who is ṣāfī i e pure This ṣāfī has become ṣūfī and in this form the name of the class of thinkers, Ṣūfī' But *Data Ganj Bakhsh* says, "A true Ṣūfī is he who leaves impurity behind" And again, "he, that is purified by love for God, is a Sufi" [10]

After analysing al-Bīrūnī's view on the origin of the word "Ṣūfī" in the foregoing lines, we understand that it is aptly a controversial term used in the ṣūfism, and we also ascertain the answer of the question in the following statement of Rūmī as to why it was defined by the theologians in the different senses? He tells a story that there was once an elephant, in a dark room and many people gathered to see it As there was darkness in the room, they could not see the elephant, they could only feel it with their hands One felt its trunk and thought that it was a water-pipe Some felt the ear and held that the animal was like a large fan Those who felt its leg, thought it to be a pillar Those who felt the back, held that it was like a throne" So it is with ṣūfism which cannot be defined in specific terms Being a student of history we understand that the various persons can only attempt to express what they have themselves felt about ṣūfism and such feeling may be different for different persons

Besides different theories about the origin of the word 'Ṣūfī' we understand that it takes its roots from the teachings of the Holy Prophet and the Holy Qur'ān

Al-Bīrūnī does not describe in detail the whole doctrine of ṣūfism. His idea about ṣūfism is given as parallels to compare and contrast with Greek, Hindu and Christian doctrines He himself says, "I shall place before the reader the theories of the Hindus exactly as they are, and I shall mention in connection with them similar "theories of the Greeks in order to know the relationship existing between them For the Greek philosophers, although aiming at truth in the abstract, never in all questions of popular bearing rise much above the customary exoteric expressions and tenets both of their religion and law Besides Greek idea we shall only now and then mention those of the ṣūfīs or of someone or other Christian sect, because in their notions regarding the transmigration of souls and pantheistic doctrine of the Unity of God with creation there is much in common between these systems."[11]

As regards the concept about God he has explained the ṣūfī doctrine that, 'those Ṣūfīs who teach that this world is a sleeping soul and yonder world a soul awake, and who at the same time admit that God is immanent in certain places e g in heaven—in the seat and throne of God (mention in the Qur'ān). But there are others who admit that God is immanent in the whole world, in animals, trees, and the inanimate world, which they call his universal appearance To those Ṣūfī who hold this view, the entering of the souls into various beings in the course of metempsychosis is of no consequence'[12]

A close examination of the above statement hints at two concepts about God The first concept is approaching that of *Wahdat al-Sh hūd* which means the universe and all that it contains is so far transcended by the majesty of God's reality that all else accounts for nothing The second concept about God is *Wahdat al-Wujūd* which holds that there is only one essence and that is God's. Thus to this school of thought everything is God and of the essence of God and its creed is *Hamah Ast* "All is He" From the contemporary history of Ṣūfīsm it transpires that only second concept was prevalent According to Sheikh Nizām al-Dīn Auliā', a great Indian Ṣūfī, 'God is immanent in his creatures There is not a single particle of the universe which is separate from them Moses asked God, "Oh Benefactor, are you near that I may call You slowly, or are You at a distance, so that I may call You loudly I hear Your voice but I do not see You Where are You?" God answered, "I am in front of you and behind you, to your right and to your left, and everywhere When any creature remembers Me, I am by his side and when he calls Me, I am near him" God says to the Prophet, "Oh Muḥammad, when people question you about My place, tell them that I am near them I am nearer to them than their jugular vein, and I am nearer to them than you are, but you do not see Me"[13]

In the last words of the quotation given in the beginning, al-Bīrūnī also speaks about the transmigration of the soul: "To those who hold this view, the entering of the souls into various beings in the course of metempsychosis is

of no consequence [14]. Al-Bīrūnī is aptly right when he says that in the doctrine of *Wahdat al-Wujūd*, the transmigration of the souls has petty importance He further says that the 'terms of the Ṣūfīs as to the knowing being and his attaining the stage of knowledge come to the same effect for they maintain that he has two souls—an eternal one, not exposed to change and alteration, by which he knows that which is hidden, the transcendental world, and performs wonders, and another, a human soul, which is liable to being changed and being born [15]

In the statement narrated above al-Bīrūnī has pointed out two kinds of souls, one is eternal or immortal and the second is human soul or mortal As a student of history we know that Ṣūfīs differ with regard to their views about soul The Ṣūfīs, like Khwājah Junayd, who championed the mortality of the soul, quoted this Qur'ānic verse, 'There are some who think survival after death are far from their understanding and asked how they shall be raised up after they have been reduced to the bones and dust Let them recall to mind that they were created out of nothing, first as dust, then a sperm, then back like clot, then piece of flesh, partly formed and partly unformed Kept in a womb for an appointed term, brought out as babes and then fostered so that they reached an age of full-strength' [16] But on the other hand those Ṣūfīs who support the theory of immortality of soul, put forward this verse of Qur'ān We breathed unto him (Adam) out of our own Rūḥ (*Nafākhtu fih min rubbī*) Ibn Khaldun says that 'the soul is subtle in nature and each particle of it is connected with each particle of the body The soul is liable to reward and punishment as it alone tasted of the pleasure on the body It is immortal in nature and after the decay of the body, assumed a thought shape' [17]

But the commentary by the author of *Sh'ri' Muwaffakh* is quite interesting who is of the view that 'the spirit will either be in ignorance or it will be in enlightenment'

Those who are in ignorance will go from bad to worse Those in enlightenment will suffer till they improve

After the analysis of the various Ṣūfī doctrines regarding the soul, we come to know that al-Bīrūnī's view about two kinds of soul coincides with the Ṣūfīs who say First, when Soul's sight is on *Mumkin al-Wujūd* (Thought world), it is called stationary soul (Rūḥ Mūqīm) and the second when the soul's sight is on *Wājib al-Wājūd* (Causal existence), it is called the travelling soul (Rūḥ Jārī)

Al-Bīrūnī sheds a bit of light on the doctrine of the Truth quoting the Ṣūfī view "As long as you point to something, you are not a monist, but when the Truth seizes upon the object of your pointing and annihilates it, then there is no longer an indicating person nor an object indicated" The approach to the

statement shows the absolute Being of God and The Truth is identical with the Essence of God. Al-Bīrūnī further says that, "There are some passages in Ṣūfism which show that they believe in the pantheistic Union e g one of them, being asked what is *The Truth* (God), gave the following answer 'How should I not know the being which is I in essence and am not separated from him and if I am neglected (i e not born anew and sent into the world), thereby I become light and become accustomed to the Union "[18] The Ṣūfī concept mentioned in above quotation depicts that God is everything and everything God but al-Bīrūnī does not agree with it We get also an idea of The Truth also from this verse of Holy Qur'ān "Truth is from God" [19] And again according to the Qur'ān "There is only one religion and not various religions because there can only be one Truth and not various Truths Allah revealed this Truth (Dīn) to His first Prophet, Adam Then a line of Prophets followed to restate the same Truth until finally, Muḥammad, the last messenger of Allah on Earth, was sent to educate mankind and to effect religious reform for the last time and for all time to come" [20]

Al-Bīrūnī also tells us how Ṣūfī attained his position in Ṣūfism through the Truth and quotes Abū Bakr al-Shiblī's wordings "Cast off all, and you will attain to us completely Then you will exist but you will not report about us to others as long as your doing is like ours [21] He further refers to the views of Abū Yazīd al-Bustamī, 'I cast off my own self as a serpent casts off its skin Then I considered my own self, and found that I was He"[22] i e God

The Ṣūfī explains the Qur'ānic passages (Sura 2, 68), "Then we spoke Beat him with a part of her", in the following manner "The order to kill that which is dead in order to give life to it indicates that the heart does not become alive by the light of knowledge unless the body be killed by ascetic practice to such a degree that it does not any more exist as a reality, but only in a formal way, whilst your heart is a reality on which no object of the formal world has any influence', Further Ṣūfīs say 'Between man and God there are a thousand stages of light and darkness Men exert themselves to pass through darkness to light and when they have attained to the stations of lights, there is no return for them" [23] The statement shows that the Ṣūfīs attain to the degree of saintships only in the light of the Truth and there are three degrees i e *Qurb-i Farā'id* (Proximity of obligations), *Qurb-i Nawā'fil* (Proximity of supererogations), In the first, the ṣūfī has no actions of his, he becomes an instrument in the hand of God, who acts through him In the second, the other is reversed and the Ṣūfī becomes an agent and God his instrument In the third degree the mystic finds himself neither as an agent nor as an instrument, but he is one with the essence of God"

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AL-BĪRŪNĪ'S POLITICAL ROLE AND PHILOSOPHY

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ABŪ Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī, though an eminent scholar of diverse interest who "never had a pen out of his hand, nor his eye off a book and his thoughts were always directed to his studies",[1] had started his career as a politician for he served as an adviser to the ruling prince of his native country Khwārizm[2] He was indebted to the Sulṭān of Khwārizm for the opportunity of visiting India, for he was appointed by him to accompany the embassies which he sent to Maḥmūd of Ghaznah[3] That contact helped him in obtaining an assignment from Maḥmūd of Ghaznah who was well-known for the patronage of learning According to Rashīd al-Dīn, "he entered the service of Maḥmūd bin Subuktigīn and in the course of his service he spent a long time in Hindustan and learnt the language of the country"[4]

The nineteenth century historian, Sachau, is of the view that al-Bīrūnī was a political antagonist and Maḥmūd after overthrowing the Sulṭān of Khwārizm, brought him to Ghaznah as a "hostage" and that al-Bīrūnī was never in the service of the state or court in Ghaznah The historian's thesis of al-Bīrūnī being hostile to Mahmūd, is based on the premise that he mentioned Maḥmūd as Amīr Maḥmūd in *Kitāb al-Hind*, which according to him "was nothing very complementary" Conceding that al-Bīrūnī also called him "Y'āmīn al-Dawlah Mahmūd, may God's mercy be with him" and once as "the strongest of the pillars of Islām, the pattern of a Sulṭān, Maḥmūd, the lion of the world and the rarity of the age, may God's mercy be with him", Sachau persists in his view that al-Bīrūnī's treatment was "cold, cold in the extreme"[5] The contention seems to be highly fallacious as even 'Utbī the contemporary historian and secretary to Maḥmūd mentions his master in his *Kitāb al-Ya'mīnī* as Sulṭān Maḥmūd with no other epithets Similarly Abū al-Faḍl al-Bayḥaqī, another contemporary historian talks continuously of "Amīr Maḥmūd" and no more in his *Ta'rīkh al Subuktigīn* Therefore it is rather difficult to believe that al-Bīrūnī was under clouds or was denied patronage by the Sulṭān.

Glancing through the Preface to the *Kitāb al-Hind* one finds that the research work was undertaken at the behest of his master Abū Sahl who held important offices at the Court of Ghaznah and remained influential long after the death of Sulṭān Maḥmūd Al-Bīrūnī first speaks of a series of exploratory discussions on the subject with Abū Sahl and then says " he incited me to write down what I know about the Hindus as a help to those who want to discuss religious questions with them, and as a repertory of information to those who want to associate with them my book is nothing but a simple historic record of facts" [6]

The questions arise as to who wanted to discuss religious questions with Hindus and who wanted to associate with them? Obviously they were the men at the helm of affairs, their motive being the establishment of a cohesive state comprising both Muslims and Hindus Going a little deeper into the question, one finds that al-Bīrūnī's ten-year stay in India involving presumably a lot of expenditure on his academic pursuits as well as official support in his day to day research for knowledge without which he could not move so freely among hostile people, are significant factors that lead us to believe that al-Bīrūnī was sent by the Sulṭān on an exploratory cultural mission in order to understand Hindu society and to find out any common values that could help integrate Hindu population within the Ghaznavid Empire, and enable it to play a healthy, constructive role

In this regard it is significant to note that al-Bīrūnī describes in the first instance, the communication barriers between Hindus and Muslims and in fact between Hindus and all foreigners and in the following chapter brings out fully the belief in one God which was common to both Hindus and Muslims He says

> "The Hindus believe with regard to God that he is one, eternal, without beginning and end, acting by free-will, almighty, all-wise, living, giving life, ruling, preserving, one who in his sovereignty is unique, beyond all likeness and unlikeness, and that he does not resemble anything nor does anything resemble him This is what educated people believe about God They call him ISWARA i e self-sufficing, beneficent, who gives without receiving They consider the unity of God as absolute, but that everything beside God which may appear as unity is really a plurality of things The existence of God they consider as a real existence, because everything that exists, exists through him" [7]

After that he talks of the vulgar notions of God prevalent among the common illiterate and semi-literate people which were the outcome of their narrow thinking aided and abetted by the pre-concerted tricks of the priests He called idols as just commemorative figures, turned into gods by the unwary people However quoting authorities in his support, he says

"For those who march on the path of liberation, or those who study

> philosophy and theology, and who desire abstract truth, which they call *sara*, are entirely free from worshipping anything but God alone, and would never dream of worshipping an image manufactured to represent him"[8]

That provided a strong basis for a subsequent dialogue between the rulers and the ruled with a view to bringing about a common ground for mutual cooperation as according to 'Utbī', the contemporary historian, Maḥmūd aimed at punishing "those who kept idols and would not acknowledge the unity of God"[9] And these were the objectives of the educated Hindus as well Only the methods differed It seems that al-Bīrūnī's analysis had partial impact on the rulers of Ghaznah as it is an historical fact that they succeeded in winning the confidence of some strong Hindu elements who were given important official assignments

Having reached the conclusion that al-Bīrūnī's role was not only cultural but also political, it becomes necessary to know his political philosophy or in other words, his concept of an ideal state On this question he thus enunciated his views

> "If a new order of things in political or social life is created by a man naturally ambitious of ruling, who by his character and capacity really deserves to be a ruler, a man of firm convictions and unshaken determination, who even in times of reverses is supported by good luck, in so far as people then side with him in recognition of former merits of his, such an order is likely to become consolidated among those for whom it was created, and to continue as firm as the deeply rooted mountains It will remain among them as a generally recognised rule in all generations through the course of time and the flight of ages If, then, this new form of state or society rests in some degree on religion, these twins, state and religion, are in perfect harmony, and their union represents the highest development of human society, all that men can possibly desire"[10]

Obviously the establishment of such a society or state pre-supposes equality between man and man That is why, while discussing the caste system of ancient Persians, al-Bīrūnī writes

> "Among the Hindus, institutions of this kind abound We Muslims, of course, stand entirely on the other side of the question, considering all men as equals, except in piety, and this is the greatest obstacle which prevents any approach or understanding between Hindus and Muslims"[11]

Al-Bīrūnī's observations on the maintenance of law and order throw further light on his concept of a state He says

> "In this regard the manners and customs of Hindus resemble those of the Christians, for they are, like those of the latter, based on the principles of

virtue and abstinence from wickedness, such as never to kill under any circumstances whatsoever, to give to him who has stripped you of your coat also your shirt, to offer to him who has beaten your cheek the other cheek too, to bless your enemy and to pray for him Upon my life this is a noble philosophy, but the people of this world are not all philosophers Most of them are ignorant and erring, who cannot be kept on the straight road save by the sword and the whip And indeed, ever since Constantine the Victorious became a Christian, both sword and whip have ever been employed, for without them it will be impossible to rule "[12]

Knowledge is the fountainhead of all progress and it is the intelligentsia comprising intellectuals and philosophers that keeps the flame of knowledge burning and opens new vistas of progress and prosperity Therefore al-Bīrūnī places great emphasis on free flow of knowledge He says

"The number of sciences is great, and it may be still greater if the public mind is directed towards them at such times as they are in the ascendancy and in general favour with all, when people not only honour science itself, but also its representatives To do this is, in the first instance, the duty of those who rule over them, of kings, of princes For they alone could free the minds of scholars from the daily anxieties for the necessaries of life, and stimulate their energies to earn more fame and favour, the yearning for which is the pith and marrow of human nature "[13]

This study of al-Bīrūnī's political role and philosophy leads us to the following conclusions —

1 That al-Bīrūnī was a scholar with a political mind, who was sent to India on a politico-cultural and informational errand in order to explore the possibilities of finding common ground among the Muslims of Central Asia and Hindus of South Asia, so that foundations for a grand, cohesive and integrated empire could be laid in which both could play an admirable role

2 That at least one common ground was discovered namely the belief in one God

3 That he visualised an orderly state that should rest in some degree on religion, perhaps on the basis of the unity of God, and the equality of man

4 That according to him the progress of society depended largely on free flow of information leading to expansion of knowledge on a grand scale and that the state could play a major role in it by affording all possible encouragement to the scholars and intellectuals

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AL-BĪRŪNĪ AND ISLAMIC MYSTICISM

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AL-BĪRŪNĪ'S acquaintance with the concepts of Muslim mystics (hereafter known as Ṣūfīs) may have been extensive or restricted Historically, his immediate sources of information on Ṣūfīs and Ṣūfīsm are not known Yet al-Bīrūnī's encyclopaedic presentation of Indian thought, known as *Kitāb al-Bīrūnī fī tahqīq mā li al-Hind min maqūlah maqbūlah fil-'aql aw mardhulah* or simply the *India*,[1] leaves no doubt that whatever the scope of his acquaintance with tracts on *taṣawwuf*, their principal value for him is functional to provide points of reference within a tradition already known to his Muslim readers, making possible the comparison of tangentially Muslim statements with references from Jewish, Persian and Christian but mostly Greek sources, for the ultimate purpose of paralleling and, hopefully, elucidating Indian religious beliefs As a comparativist al-Bīrūnī is wide-ranging in his repeated references to non-Indian authors and their writings, but his single, constant focus in the *India* is Hindu thought and its comprehensibility to his Muslim readers It is noteworthy, therefore, that the *India* does not include an independent treatment of Ṣūfism, nor does it provide an attempt to evaluate the principal tenets of *taṣawwuf* vis-a-vis the other branches of institutional Islām, Sunnī or Shī'ite

Outside the *India*, al-Bīrūnī makes few references to Ṣūfism In the *Chronology* there is a solitary exposition of the teaching of Husayn b Manṣūr al-Hallāj,[2] and there is a further allusion to Ṣūfī leaders in the *Kitāb Batanjal*[3] To determine al-Bīrūnī's use of characteristic Ṣūfī expressions, therefore, one must consult the numerous but cryptic *India* passages pertaining to *taṣawwuf* Ideally our task ought to be twofold (1) to examine explicit reference to Ṣūfī thought - whether the name of a particular writer is provided, or, as in most cases, authorship remains anonymous, and (2) to determine the use of Ṣūfī concepts or technical terms in the general context of al-Bīrūnī's discourses on religious traditions This second level of investigation would be especially profitable if directed not only to the *India* material but also to the *Kitāb Batanjal*[4]

Yet, because of the frequency and complexity of al-Bīrūnī's references to Ṣūfism in analyzing Hindu thought, the present essay will concern itself mainly with the *India* passages where explicit reference is made to Ṣūfī patterns of belief If we presume to suggest that human reason and historical imagination will lead us to understand what an author of nearly 1000 years antiquity and veneration

intended to say about Ṣūfism, then at a later date we might assay the further task of laying bare Ṣūfī categories dimly reflected in the ***Kitāb Batanjal*** as well as the *India*

It is in the second through the seventh chapters of the *India* that we find most of the references to *taṣawwuf*[8] appearing in several contexts to illustrate a variety of doctrinal positions The intention of these chapters is to summarize the Hindu outlook and thereby provide a frame of reference for the reader who ventures into the maze of mathematical and scientific data that follow With respect to the span of topics included in the *India*, Chapters 2 - 7 appear to be straightforward and easy to understand In themselves, however, they telescope a vast segment of medieval thought into a very few paragraphs, with the result that it is no minor feat to unravel the original context and intention of particular passages whether they pertain, as in most cases, to the views of the ancient Greeks or, on occasion, to the views of the Ṣūfīs

The chapter headings supply minimal signposts for the unsuspecting reader After a general introduction (Chapter I), al-Bīrūnī explains the structure of Hindu belief under six topical rubrics

1 God (ch 2)
2 The interaction of intelligible with sensible objects (ch 3)
3 The connection of soul with matter (ch 4)
4 Metempsychosis (ch 5)
5 Cosmology (ch 6)
6 Liberation (ch 7)

The categories, in fact, overlap, and the chapter divisions only roughly correspond to their content It would be possible to label the same material as four aspects of Indian thought, with the following distribution

GOD	as transcendent being (ch 2)
	as human creation (ch 3a)
SPIRIT	as apogee of Samkhyan thought (ch 3b)
	as corporeal and, hence, contaminated (ch 4)
TRANSMIGRATION	its conceptual basis (ch 5)
	its topography (ch 6)
SALVATION	(ch 7)

The glaring distinction of Hindu from Muslim belief occurs in the third category, and al-Bīrūnī has underscored and memorialized the distinction by his oft quoted remark *al-tanāsukh 'ilm al-nihlah al-hindawīyah*[6] "Metempsychosis is the password of Hindu belief" Yet even on this topic Hindus are not adjudged to be unique, for it is in his prefatory remarks concerning the Greeks that the Ghaznavid savant first applauds the ancient philosophers as those who endeavoured to discover the truth[7] and then compares them to Ṣūfīs and Christian sectaries as partners with the Hindus in propounding the twin beliefs of transmigration and unification[8]

Transmigration only becomes the central topic for consideration in two chapters of the *India* (5-6), while unification is not stressed till the discussion of salvation in Chapter 7 Together, however, they become the organizing principle for the material on Hindus' doctrinal beliefs in the initial chapters of the *India*, and it is in relation to them that the excerpts from Greek sources assume a primary importance, while Ṣūfism becomes an adjunct discipline, deriving even its valuation from the treatment of the Greek material

Consider, for instance, Chapter 1 The pagan Greeks are discussed at length According to al-Bīrūnī, they are like the Hindus in two respects (1) their upper and lower classes have more in common cross-culturally (Greek to Hindu, Hindu to Greek) than they do linearly (Greek to Greek, Hindu to Hindu), for in both cases the upper classes are philosophers and/or scientists, while the masses are ignorant rabble[9] as heathens, all Greeks and all Hindus are alike since they represent a common deviation from the truth[10] The phrase 'deviation from the truth' (*al-inhirāf 'an al-haqq*) sounds like a canon of Muslim orthodoxy, and whether al-Bīrūnī genuinely holds such a conviction or is advancing it to please the monarch (Maḥmūd of Ghaznah) under whose patronage his *India* was completed[11] is a moot question If all heathens are lumped together as deviates from the truth, then Ṣūfī as well as Hellenistic categories of thought are implicitly condemned Such a judgement is given added weight when one realizes that nowhere in the *India* is Sūfism cited except as a serial addition to examples either of Indian or Greek speculation

It would not be amiss to say that the introductory remarks in the *India* concerning Greek thought lead to two seminal insights into al-Bīrūnī's perception of Ṣūfism First, while all Greeks, Indians and Ṣūfīs are condemned for their collective, corporate expression of False Belief, some individual Greeks but no Ṣūfīs are partially extolled for their aspirations to understand the Truth There is no Ṣūfī counterpart to the tribute paid to Socrates who, though suffering at the hands of his ignorant countrymen died, according to al-Bīrūnī, as one who "did not recant from the Truth"[12] Secondly, it is al-Bīrūnī's own vision of the Truth which not only governs his life and work but determines the spirit of his inquiry into the Indian mind For al-Bīrūnī the truth of Islam is above question he does not subject it to the same scrutiny which prompts him to lay bare the premises for Indian belief in transmigration and unification Both the *India* and the

Chronology contain scattered references to the historical cleavances within the '*ummah*, but they are few and seldom polemical in intent [13] When excerpts from Ṣūfī writings appear in the *India*, as they often do, their proponents are not castigated, only the *Chronology* depiction of extreme Ṣūfism, as attributed to al-Ḥallāj and his followers, seems to have piqued al-Bīrūnī [14] The generally irenic approach to sectarianism which characterizes his work appears to derive from an unquestioning acceptance of his inherited faith, coupled with a dogged pursuit of the highest Truth

The larger number of references to *taṣawwuf* rather than to other Muslim traditions - sectarian or orthodox - in the *India* cannot, therefore, be attributed to al-Bīrūnī's acceptance of Ṣūfī views, rather it is the fundamental parallelism which he perceives between Ṣūfīs, Greeks and Hindus, especially on the pivotal topics of transmigration and unification, that prompts al-Bīrūnī to make frequent mention of the mystical branch within Islam In Chapter 2, when the topic under surveillance is God as transcendent being, reference to Ṣūfism would be cumbersome at best and hence is omitted Yet in introducing the Hindu view of the origin of matter in Chapter 3, al-Bīrūnī can and does suggest a Sufi parallel for the first time in the *India* Unfortunately, the context obscures the exact referent which he had in mind After setting forth the Greek postulate of the First Cause as a self-sufficient and independent entity, al-Bīrūnī adds, almost parenthetically, that the Ṣūfīs also adhere to this belief [15] But which Ṣūfis? In which writings? And to what extent? We are not told the answer to these questions Subsequently, al-Bīrūnī refers to the Ṣūfī affirmation that the seeker who turns to the First Cause will after intermediate stages of ascesis become united with it In all likelihood, this second reference to *taṣawwuf* in Chapter 3 interprets the first, linking both to the central concept of unification ('*ittihād*) mentioned in the Preface as common to Ṣūfīs, Christians and Greeks as well as Indians.

Wedged in between the two citations to Ṣūfī tenets in Chapter 3 is a lengthy digression the purpose of which is not immediately clear After the initial mention of the word Ṣūfī, al-Bīrūnī elaborates its meaning The excursus does not develop the particularity of Ṣūfī thought, at the same time that it is remote from Hindu parallels It does suggest, however, that in a mistaken line of reasoning the word Ṣūfī can be linked to Greek philosophy, thus implying that the Ṣūfīs themselves felt dependent on the modes of rational discourse as well as the popular beliefs emanating from Athens Such a negative valuation of *taṣawwuf* as a tradition that derives not only its substance but its name from a non-Islamic source is partially offset by the concluding remark of al-Bīrūnī's etymological excursus Abū al-Fatḥ al-Bustī is quoted, and it appears that his view echoes al-Bīrūnī's own judgement, namely, that the word *ṣūfī* derives from a word - play *ṣāfī* (pure) and hence refers to 'a class of (pure) thinker' [16]

In the remainder of Chapter 3 of the *India* is no further reference to Ṣūfism Only in discussing the concept of God and particularizing the names by which

various peoples refer to Him does al-Bīrūnī give as the canonical Muslim definition of God *Allāhu al-haqqu al-mahḍu*, i e, God is pure Truth Elsewhere in both the *India* and the *Kitāb Batanjal* al-Bīrūnī uses *al-haqq* as the conclusive and distinctly Muslim way of describing God The emphasis is curious, and may exemplify the indirect influence of *taṣawwuf* on al-Bīrūnī's vocabulary about which we spoke at the outset of this investigation [17] Though the term *al-haqq* recurs in the Hellenistic as well as the Ṣūfī traditions, as a name of Allah it becomes emphasized in Ṣūfī vocabulary after the time of al-Hallāj (d 992 A D) and seemingly as a result of his influence [18] While it is unlikely that al-Bīrūnī would trace his definition of the divine to al-Hallāj or any Ṣūfī author, it is of interest that he knows of al-Hallāj and quotes him directly in the *Chronology* and indirectly in the *India* [19]

In the Preface to the *India* al-Bīrūnī had declared his intention to use Ṣūfī teaching to explicate the concept of transmigration as it appeared in the Greek and Hindu traditions The next references to Ṣūfism, accordingly, come at the end of Chapter 5 as doctrinal tenets corresponding to the philosophical bases for transmigration which up till then have been elaborated only with reference to Greek and Hindu material [20] The remarks are brief but specifying The Ṣūfīs, according to al-Bīrūnī, maintain that this world is a sleeping soul and that (other) world a waking soul They also assert that God (*al-ḥaqq*) is immanent in certain places - in heaven, for instance, in the seat and throne [21]

There are several aspects to these observations that merit further comment

(1) Metaphor of the two worlds as sleeping and waking souls respectively is most frequently cited in the literature of Hellenistic and Iranian gnosticism Both the *Great Book of the Mandaeans* and the *Corpus Hermeticum* resonate with references to sleep as the condition of the soul in matter, its moral turpitude is underscored by the sequential depiction of earthly existence as numbness, drunkenness and oblivion [22] In contrast, awakening from sleep and recovering from sloth is spurred by the call from without Indeed the first effect of the call is always seen as wakefulness

Note, for instance, the command to the Primal Man

> Shake off the drunkenness in which thou hast slumbered, awake and behold me !

(2) While the general distinction between sleeping and waking does exist in *taṣawwuf*, it is expressed with neither the frequency nor the poignancy characteristic of the Hellenistic/Iranian tradition Early Ṣūfism stressed, instead, *tawbah* or repentance as the initial, essential step (*maqām*) to attaining the Truth It is noteworthy that *The Recital of Hayy b Yaqzān* was the topic

of a philosophical/mystical discourse by al-Bīrūnī's contemporary, Ibn Sīnā,[24] but it seems unlikely that al-Bīrūnī would have generalized as Ṣūfī in inspiration a solitary detail from a man whose works he appears to have largely ignored[25]

In sum, lacking information about al-Bīrūnī's immediate source for the metaphor of the sleeping and waking souls, we must entertain the possibility that he is ascribing to *taṣawwuf* a tradition that only vaguely pertains to the genre of mystic thought

(3) The subsequent reference to the seat and throne of God is also problematic - not for its location in Ṣūfī literature, which is secure by the time of al-Bīrūnī but for its applicability in the sense which al-Bīrūnī suggests. Both terms, of course, derive from Qur'ānic observations about the Throne of God, in most instances described as *'arsh* but in two passages (Q II:255 and XXXVIII 3 4) as *kurṣyī* The discrepancy has invited extensive speculation which has exercised the imaginations of Qur'ānic commentators since the early centuries of Islam[26] The deeper question concerns the interpretation of the Throne as a literal or metaphorical abode of God In Ṣūfī parlance its characteristic intention seems to be metaphorical Consider, for instance, Abū Yazīd al-Bistāmī, whose *shaṭahāt* al-Bīrūnī knew and quoted at least once in the *India*[27] When Abū Yazīd reached the Divine Throne, it is said, he found it empty and threw himself upon it, in other words, sitting on the Throne was an allegory for his discovery of the divine element in himself[28] The Throne can only be interpreted to connote *hulūl al-haqq*, or the indwelling, of God, insofar as awareness of the Godhead potentially exists in the soul of every human being Al-Bīrūnī, by contrast, implies that the Ṣūfīs believed the Throne and/or the Seat literally embodied the Divine Being, and in this sense his ascription is less appropriate to Ṣūfī teaching than to the views of the anthropomorphists which by the fourth century A H had come to be condemned as unorthodox[29]

(4) The context of al-Bīrūnī's succinct references to *taṣawwuf* at the end of Chapter 5 uncovers some of the ambiguity surrounding both sets of images 'The same doctrine,' of which al-Bīrūnī speaks at the outset of the final paragraph, is the doctrine that the transmigrating force of the soul impels rebirth from one body to another Yet neither of the allegedly Ṣūfī tenets suggests metempsychosis so much as the desirability of ascent from the lower to the higher world The frame of reference could as easily be a single or a multiple existence for sentient beings Why then does al-Bīrūnī include these random offerings of purportedly Ṣūfī origin? It is possible that the preceding series of quotations from Greek writings, which are far more extensive and detailed than Ṣūfī references, here as elsewhere in the *India*, proved to be misleading The two excerpts from Plato[30] clearly elaborate the manner in which souls migrate from form to form, but in the final passage Proclus simply speaks of properties (knowing and forgetting) which govern the

relationship between soul and body In all probability, it was this last thought which in its cleavage of soul from body, reminded al-Bīrūnī of the ascetical tradition within Ṣūfism, prompting him to conclude his introduction to Indian views on rebirth with some summary images that bear only a distant relationship either to actual Ṣūfī teaching or to the concept of metempsychosis

When we proceed to Chapter 6 of the *India*, however, we find a lucid exposition of the mechanics of transmigration that defies comparison with any medieval Muslim text on the subject. One especially graphic quotation concerns the view of a *mutakallim* on the four stages of transmigration *naskh*, *maskh*, *faskh* and *raskh* [31] Al-Shahrastānī mentions the same four stages without elaboration and attributes their profession to an extreme Shī'ite group, the Kāmilīyaḥ [32] Sachau, however, assumes that the person to whom al-Bīrūnī alludes is a Ṣūfī, translating *mutakallim* as 'theosoph' [33] Since the word has an ambiguous history,[34] the *mutakallim* in question could have been either Ṣūfī or Shī'ite, and al-Bīrūnī does not provide further clues as to the identity of his source Yet the Ṣūfī affiliation seems questionable, especially since belief in transmigration did not appeal to certain major expositors of *taṣawwuf* till after al-Bīrūnī's time [35]

If we omit from consideration this last reference in Chapter 6 or minimize its relevance to Ṣūfism, we are left with no major statements of Ṣūfī doctrine in the *India* which parallel either Greek or Hindu views on metempsychosis In itself this conclusion is not astounding though it mildly contradicts the prefatory statement about the value of Ṣūfism for understanding the Hindu tradition

At the same time, it does point to the importance of that other aspect of Hindu thought for which Ṣūfī examples were to be adduced, namely, unification Briefly mentioned in Chapter 3[36] the topic of unification is not broached again till Chapter 7 The case for or against al-Bīrūnī's understanding of Ṣūfism rests squarely on the citations of this chapter, and we will now turn our attention to its contents [37]

Chapter 7—concerning Liberation or Salvation—is the final, the lengthiest and the most decisive chapter in the section of the *India* dedicated to expositing Hindu beliefs Two structural features separate the *taṣawwuf* material in this chapter from that which preceded it Portions of two verses from the Qur'ān are explicitly cited, together with the Ṣūfī commentary on their content Neither of them is identified with a particular author, but elsewhere in the same chapter two prominent Ṣūfīs are mentioned by name, Abū Bakr al-Shiblī and Abū Yazīd al-Bistāmī, and a sampling of the *shaṭaḥāt* ascribed to them is set forth The inclusion of these amplified references to *taṣawwuf* is in itself sufficient to underscore the importance of Chapter 7 for al-Bīrūnī in describing the Indian doctrine of release of salvation, he wants to provide his Muslim readers

with the most cogent and lucid examples from the cross-cultural material available to him.

The thread of cohesion linking together the Ṣūfī references in Chapter 7 is unification or *ittiḥād* On the one hand, unification is treated in relation to the miraculous feats which precede it but are also superseded by it, on the other, unification is examined as an epistemological process for which the only imagic equivalent is light

The two passages pertaining to *siddhis*, i e, extraordinary powers which issue in miraculous acts, are separated by several pages in the *India* text,[38] yet they constitute a unit from the perspective of al-Bīrūnī's use of Ṣūfī categories and hence will be treated together

The first passage appears at the beginning of Chapter 7, after al-Bīrūnī has elaborated a number of *siddhis* from the third chapter of the *Yoga-sūtras*[39] His intention is to clarify the nature of detachment (Ar, *istighnā*, Skt, *vairagya*) only the yogin who has achieved the *siddhis* may become detached from them and attain a still higher level of realization[40] Al-Bīrūnī sees a parallel between this teaching and the Ṣūfī description of the gnostic (*al-'ārif*) and the stage of gnosis (*maqām al-ma'rifah*) According to the Ṣūfīs, in his view, there are functions and qualities appropriate to the two souls (*rūḥān*), the one eternal, unalterable, performing miracles, the other human, changing, coming into existence Nothing further is said about how the two souls of *taṣawwuf* relate to the yogin *siddhis*, and once again we have to search for Ṣūfī antecedents outside the text of the *India*

The *rūḥān* to which al-Bīrūnī refers are usually depicted in Ṣūfī manuals as the spirit or *rūḥ* and the lower soul or *nafs*[41] Both are said to be subtle substances existing in a single body, and both are linked to opposite functions not dissimilar from those included in al-Bīrūnī's brief vignette,[42] except for the performance of miracles Early Ṣūfī writings do not stress wonder-making powers, and even if one were able to find a passage or two from accounts by pre-tenth century (A D) Ṣūfī enthusiasts which make mention of extraordinary feats, how would they measure up to the extensive faculties which are systematically elaborated as benefits of *samyama* throughout Book Three of the *Yoga-sūtras*? Clearly the two traditions of *taṣawwuf* and Yoga have disparate emphasis on the development of psycho-physical powers, and one might be led to question al-Bīrūnī's sound judgement as a comparativist if there were not a second passage in Chapter 7 of the *India* which also pertains to the *siddhis* and Ṣūfīs

In the second passage,[43] as in the first, al-Bīrūnī is trying to explain how the transformed body of the yogin is said to become a vehicle for the soul instead of a barrier to it Again, he reverts to Ṣūfism for exemplification of his basic point Instead of drawing the contrast between the two levels of the soul, however, as he had done earlier, al-Bīrūnī explains the point analogically by citing a Ṣūfī story and then a verse from the Qur'ān (XVIII: 84), together with its commentary

The data is uneven While the story itself is a mystery, being untraceable as well as anonymous, its effect is clear to show that a student of *taṣawwuf* in the state of intense prayer can experience a unification (*'ittihād'*) of body and soul which allows him to die at will The Qur'ānic verse, on the other hand, is clear in its origin and initial context but its applicability to Ṣūfism is less certain The unnamed subject of the verse is Dhū al-Qarnayn, and although it is apparent from the *Chronology* that al-Bīrūnī was aware of both Dhū al-Qarnayn and his legendary exploits, there is no mention of details which would link this protean creature to the Ṣūfī tradition [44] Perhaps in a commentary such as the *Ḥaqā'iq al-tafsīr* of al-Sūlamī (d 1021 A D),[45] the legendary properties ascribed to Dhū al-Qarnayn were transferred to the Ṣūfī adept or *murīd* But it seems strange both that a commentator would have generalized the extraordinary qualities of a rare and mythical person such as Dhū al-Qarnayn and that al-Bīrūnī would have accepted such attribution without question or notation Moreover, as we mentioned above, reliance on magical feats did not appear to be a common element in the self-conception of early Ṣūfī communities

Yet the question concerning al-Bīrūnī's source for this block of Ṣūfī material cannot obscure the fact that its inclusion in Chapter 7 places the earlier reference to *siddhis* and their Ṣūfī equivalent in a new perspective What appeared in the first passage as an awkward or extraneous detail is here explicated with reference to one of the most miraculous legendary figures in the Islamic tradition Dhū al-Qarnayn Whatever the actual relation of the passage to *taṣawwuf*, it is an ingenious citation on the part of al-Bīrūnī which at the least amplifies the ambiguity of his first reference to 'miracle-working' among the Ṣūfīs and safeguards his reputation as an innovative comparativist

Unification as an epistemological process the literary focus of which is light describes the remaining catena of Ṣūfī references in Chapter 7 of the *India* [46] They appear at the end of this chapter,[47] and seem to be shrouded by an initial error After quoting the tree dialogue between Arjuna and Vasudeva, which could only hark back to *Bhagavad Gita*, Ch 15, al-Bīrūnī begins the first of his unprecedented string of six Ṣūfī quotations by declaring *ilā ṭarīqī Batanjal*, that is, 'related to the teaching of *Patanjali* is' etc Sachau says nothing about this seeming confusion of the *Bhagavad Gita* and the *Yoga-sūtras* [48] While it is possible that al-Bīrūnī made an outright error, it seems more probable that he is speaking of the Samkhyan doctrine common to all three of the major Hindu doctrinal texts known to him [49] An essential element of Samkhyan metaphysics is the assumption of two worlds, *prakriti* and *purusha* (matter and spirit), which interrelate in the endless round of rebirth but separate in the state of release In Patanjali's *Yoga-sūtras* as well as in the *Bhagavad Gita* frequent metaphor to describe the state of release is light, and it was perhaps the mention of *al-anwār al-ilāhiyah* (the divine lights) at the conclusion of the *Gita* quotation which brought to mind Patanjali *and* the Ṣūfīs, producing the apparent error in the Arabic text

Of the six quotations which follow four have been scrutinized by L Massignon,[50] and it is valuable to consider their import with reference to his observations

> The first text (he states) is from Hallāj, and we have studied it in its place for its theory of the *shahādah* It is more than the *samādhi* of Patanjali (as Bīrūnī implies), since it is, in addition to the renunciation of the soul (i e , of the body by the soul), the actual transformation (of the soul) in God
>
> The second text, which is anonymous and probably later, brings to mind a commentary on the *'An al-Ḥaqq'* from the school of Hallāj
>
> The third, from Shiblī, is equally an elliptical condensation of the thesis of Hallāj
>
> The fourth, from Bistāmī, inspite of its extreme brevity, is monist only in appearance, though one may find some Hindu analogies in its method

For the initial text, Massignon has provided a substantive and incontrovertible identification It is not special interest that this Hallājian commentary Q III 27 appears in al-Sūlamī's *Haqā'iq al-tafsīr*,[51] increasing the likelihood that the two Qur'ānic passages, with commentary, which are cited elsewhere in the *India* to illustrate Ṣūfī tenets[52] may also be traceable to al-Sūlamī

At the same time, however, Massignon's analysis of the text itself seems heavily weighted in favour of al-Hallāj's theological independence from the Hindu parallels which al-Bīrūnī adduces The issue at stake is the ultimate condition of the saved soul Both Massignon and J Houben[53] argue that Hindu ascesis provides for renunciation but no transformation *The evidence of the Yoga-sūtras* themselves, especially I 41 and IV 23, suggest the equivocal nature of such a judgement, and in the *Kitāb Batanjal*[54] as well as the *India*, al-Bīrūnī indicates that he, too, has perceived the transformational quality in the soul which Yoga mandates

With respect to the second passage in this series, Massignon, by focusing on the source critical problem, neglects the distinctiveness of al-Bīrūnī's contribution as a student of comparative religions The Ṣūfī narrative appears to describe the distinction between normative and meditative consciousness, but it can also be shifted, as al-Bīrūnī implies, to explain the difference between return into another bodily existence and release from rebirth, hence relating both the first and second passages to the interlocking Hindu conception of *samsāra/moksha*

Similarly, both the third and fourth quotations appear to supplement and reinforce each other as still another explanation of the Ṣūfī approach to release Both stress *tajrīd* or renunciation While the excerpt from al-Shiblī provides a general description of the transformation that takes place through *tajrīd*, the *shaṭh* of Abū Yazīd aphorizes the ultimate condition of the saved soul

It is the example chosen by Abū Yazīd, the serpent casting off his skin, which has sparked much conjecture concerning Hindu influences on early Ṣūfī thought, and is worthy of brief exploration here Even Massignon allows the possibility that Abū Yazīd's teaching may represent an instance of cross-cultural borrowing,[55] Zaehner, for his part, eliminates all semblance of scholarly modesty by asserting that in this *shaṭh*, Abū Yazīd is quoting his spiritual master, Abū 'Alī al-Sindī, who knew the Upanishads first-hand[56] The geographical argument against Zaehner's unqualified assertions is lodged already in Massignon's footnote to the effect that there are two Sinds, one in Irān, another in India, casting doubt upon the allegedly Indian origins of Abū Yazīd's mysterious teacher[57] The theological counter-argument is advanced by S H Naṣr, namely, that certain aphoristic dicta 'are so universal and so deeply rooted in the texture of reality that they do not need to point to any historical borrowing whatsoever '[58]

The particular *shaṭh* of Abū Yazīd cited in the *India* poses an additional, literary critical problem for Zaehner's postulation of Vedantian influence on early Ṣūfism The *Brhadaranyaka Upanishad* text, as allegedly summarized in the *shaṭh*, is not contiguous The verses which Zaehner cites are *BU* 4 4 7 12 It is their fragmented juxtaposition which cloaks the dominant stress of this and virtually every Upanishadic passage the search for the awareness 'I am He' comes from no other motive than the fear of rebirth The *shaṭaḥāt* of Abū Yazīd, by contrast, fail to indicate that he supported belief in transmigration, any more than did al-Shiblī or al-Hallāj Later Ṣūfīs did occasionally subscribe to such belief, as we indicated above,[59] and al-Bīrūnī is already aware of the possible elision between Ṣūfī teaching and acceptance of rebirth, e g , in the second of the six passages under consideration However, it is a recurrent error on the part of Zaehner and others[60] who wish to connect Vedanta to early Ṣūfism that they overlook the absence of Ṣūfī references to the fundamental stress on *samsāra* in Indian thought, while simultaneously exaggerating the significance of parallel textual assertions pertaining to unification

The final two quotations of Chapter 7 in the *India* are omitted from Massignon's analysis, and they also appear to have baffled Sachau[61] Once again, it seems probable that the source of this Ṣūfī commentary is traceable to al-Sūlamī's *Ḥaqā'iq al-tafsīr* or to an early handbook on *taṣawwuf* of comparable quality

The dominant metaphor in the commentary and in the passage which follows is light the heart becomes alive 'by the lights of knowledge' (Ar., *anwār al-ma'rifah*), while it is attainment to 'the stations of light' (Ar , *maqāmat al-nūr*) that brings the security from which there is no return of fear, i e , no rebirth into the endless go-round of human existence

Emphasis on the luminous quality of saving knowledge has as its immediate referent in the *India* the *Bhagavad Gita* depiction of *al-anwār al-ilāhīyah*,[62] at the same time that it invites comparison with the passage on al-Hallāj in

the *Chronology* According to al-Bīrūnī, al-Hallāj describes himself and is described by his followers chiefly with reference to light imagery He is at once 'the beaming, shining light' (Ar, *al-nūr al-sāṭi' al-lāmi'*), of whom his followers could say

> *Al-bārī' al-qadīm al-munīr al-mutasawwir fī kullī zamānin wa-awānin wa-fīhādha fī surati al-Ḥusayn ibn Manṣūr zamāninā*)
>
> The ancient Creator, the Giver of Light, Who reveals Himself in every time and age, and in this our time (He has revealed Himself) in the form of al-Ḥusayn ibn Manṣūr [63]

Reference to light as an image of divine transcendence exists both in Ṣūfism and in Iranian religious thought independent of Islam or Ṣūfism Hence, the language of the final quotation from Chapter 7 of the *India* could be referred as easily to Manichaean or Zoroastrian antecedents as to any tenet of *taṣawwuf* Yet its inclusive quality provides the fitting culmination to an exposition of the Indian concept of salvation Liberation or salvation as a goal has many expressions, i e, stations of light The specific image of stations of light suggests the hieratic pattern of stages in the Ṣūfī path, but it is equally true that any point of progress toward the light holds out the prospect of removing darkness, defeating death and, above all, avoiding rebirth

In sum, the final catena of quotations in Chapter 7 of the *India* not only draws selectively upon major expositions of *taṣawwuf* it also summarizes the intent of the preceding excerpts from a variety of Greek and Hindu authors Unification is the answer to the body/soul, matter/spirit, dilemma for Ṣūfīs as well as for their philosophical counterparts in Athens and Benares In the earlier pages of the *India*, where references to Ṣūfism are linked to belief in transmigration and miracle-making, the tone of al-Bīrūnī's comparisons is not as convincing as at the end of Chapter 7 when unification becomes the sole topic of explication and comparison

Yet the daring of al-Bīrūnī's undertaking pales any effort to dwell on the imprecise edges which we may now detect in details of his analysis That the *India* exists is itself testimony to the fertile mind of a scholar whose search for the truth knew few restraints, and the specific investigation of al-Bīrūnī's approach to Islamic mysticism, as reflected in the *India* passages explicitly linked to *taṣawwuf*, must eventuate in a mixture of wonder and humility For what we have attempted is the understanding of glimpses into al-Bīrūnī's use of Ṣūfī categories and quotations It is evident, moreover, that al-Bīrūnī's references to Ṣūfism are themselves but glimpses into the vast tradition of Islamic mystical thought as it evolved up to and throughout his lifetime Can we then claim to have achieved a modestly accurate portrait of al-Bīrūnī's comprehension of *taṣawwuf*, or does honesty compel us to acknowledge that our efforts have produced— to adapt a phrase from Jāmī - *lawā'iḥ-i lawā'iḥ*, glimpses of glimpses?

BIBLIOGRAPHY

1 The quotations which follow will be given both in Arabic (Hyderabad, 1958) and in English (E C Sachau, trans , *Alberuni's India*, London, 1910, reprinted, Delhi, 1964)

2 See E C Sachau, ed (*Kitāb al āthār al-bāqiyah 'an al-qurūn al-Khāliyah* (*Chronologie orientalischer Volker von Alberuni*), Leipzig 1878, pp 211-212, trans , *The Chronology of Ancient Nations*, pp 194-195

3 *a'immat al ṣūfiyā* See H Ritter, "Al-Bīrūnī's Ubersetzung des Yoga-sūtra des Patanjali', *Oriens* 9 (1956), p 167, and S Pines/T Gelblum, 'Al-Bīrūnī's Arabic Version of Patanjali's *Yoga-sūtra*', *Oriens* 20 (1967), p 310

4 Pines/Gelblum, *op cit*, pp 309, 317, 319, 321-2 (fns 58, 137-8, 165, 188, 199) provide some examples of al-Bīrūnī's implicit reliance on the language of Muslim mystics, but the examples could be multiplied with reference to the other three chapters of al-Bīrūnī's unprecedented—and unsurpassed—venture into the realm of Hindu-Muslim metaphysics

5 A solitary exception is the brief allusion to Ṣūfism in the *India*, ch 35 for the purpose of explaining the Hindu view of Purusha See Hyderabad, p 296, Sachau I, p 351

6 Hyderabad, p 38 Sachau I, p 50

7 (*wa-in*) *taharr al-tahqīq* Hyderabad, p 5, Sachau I, p 8

8 *Ibid* Note that the terms are *hulūl* and *ittihād* for transmigration and unification, respectively Each word has a long history in Islamic thought, and the Christians undoubtedly meant something different by *hulūl* than did either the Ṣūfīs or Hindus [see L Massignon - (G C Anawaṭī), "Hulūl", EI III, 570-571], but in this context *hulul* appears to mean 'transmigration' or 'reincarnation' and to be linked with *tanāsukh* See also in *Kitāb Batanjal*, H Ritter, *op cit*, p 167, Pines/Gelblum, *op cit*, p 309

9 In Chapter II of the *India* al-Bīrūnī brings out the same distinction between educated and uneducated strata of ethnic/religious groupings in discussing Hindu idol worship Within Islam a point of contrast to al-Bīrūnī's depiction of ignorant idolaters may be found in the "*Ārā' al-hind*" section of al-Shahrastānī's *Kitāb al-milal wal nihal*, see B Lawrence, "Shahrastānī on Indian idol Worship", *Studia Islamica* XXXIV, 1973, pp 61-73

10 Hyderabad, p 18, Sachau I, p 24

11 On the matter of al-Bīrūnī's personal religious belief, as reflected in his extant writings, see, for instance, the reasoned conjecture of E.S.

Kennedy ("Al-Bīrūnī, Abū Rayḥān Muḥammad ibn Aḥmad" in G C Gillespie, ed *Dictionary of Scientific Biography*, vol II, p 156)

As for religion, Bīrūnī was doubtless a sincere Muslim, but there is no firm evidence of his having been an adherent of any particular sect within the faith In the *Chronology* (trans pp 79, 326), written at the court of Qābūs, are passages that have been interpreted as betraying a Shī'ī (hence anti-Arab and pro-Persian) bent On the other hand, the *Pharmacology*, compiled under Ghaznavid patronage, represents the author as an orthodox Sunnī Probably these two situations reflect no more than the fact that the two patrons were Shī'ī and Sunnī, respectively While agreeing with the tone of Kennedy's remarks, we might note that the high praise accorded the Zaydīs and 'Alids in the *Chronology* (see trans pp 69 and 183 as well as 79, 326) is balanced by a condemnation of superstitious practices and ignorant calculations along certain Shī'a (see trans pp 79, 182-3 and 294) Other accounts of al-Bīrūnī's personal religious belief are to be found in S H Baranī, 'Ibn Sīnā and al-Berūnī', *Avicenna Commemoration Volume*, Iran Society (Calcutta) 1956, p 7 and S H Nasr *An Introduction to Islamic Cosmological Doctrines*, Cambridge, 1964, p 114

12 Hyderabad, p 19, *qaḍā nahbahū ghayra rāji 'in 'an al-haqq* (Sachau I, p 25)

13 Exceptions are the *ahl al-tashbīh* or anthropomorphists and the Jabriyah against whose views he inveighs in the *India* (Hyderabad, p 23, *Sachau* I, p 31) as well as the uninformed Shi'ah mentioned in the *Chronology* (see *supra*, fn 11) In each case, however, it is not the sectarian posture but the superstitious idiocy of the individuals or groups which irritates al-Bīrūnī

14 See trans, pp 194-195, Ar, 211-212

15 Hyderabad, p 24, Sachau I, p 33

16 The Ṣūfīs themselves disagree about the appropriateness of using the word '*ṣafā*' except as an alliterative to explain the origin of their name, See, e g, al-Kalābadhī, *Kitāb al-ta'arruf li-madhhab ahl al-taṣawwuf* (A J Arberry, trans, *The Doctrine of the Ṣufis*, Cambridge, 1935, pp 9-10), where the link to *ṣafā* is refuted Yet al-Hujwīrī (R A Nicholson, trans, *The Kashf al-mahjūb*, London, 1911, pp 30-11) while admitting that *sāfā* may not be linked etymologically to *taṣawwuf*, avers that there is propaedeutic value in contrasting pure spirituality (*ṣafā*) with impure affections (*kadar*)

Concerning the pun of *ṣūfī* and *sophia*, which suggests a direct derivation from Hellenistic sources, it is ironic that Sachau (I, 33) gives *ṣūf* vice *sūf* as the stem, for al-Bīrūnī begins by spelling the word with a *Sīn* rather

than a *ṣād* (see the double instance of '*ṣūfīya*' and '*ṣūfī*' in Hyderabad 24), suggesting that he understood the etymological subtlety later elaborated by Noldeke, namely, that "the Greek *sigma* regularly became *sīn* (and no *ṣād*) in Arabic and that there is no Aramaic intermediary between *sophos* and *ṣūfī*" (See ZDMG XLVIII, p 45 and *Shorter Encyclopaedia of Islam*, *Taṣawwuf*", p 579) The other two 'false' derivations mentioned by al-Bīrūnī, namely, *ahl al-ṣuffā and ṣūf*, have contrasting positions in the academic study of *taṣawwuf* while the first is still regarded as a transparent play on words to link Ṣūfīs with the Companions of the Prophet, the latter is generally acknowledged as the probable root for the term denoting Muslim mystics See, e g, the extensive tracing of textual references to *ṣūf*, *ṣūfī* and *ṣūfiyā* in L Massignon, *Essai sur les origines du lexique technique de la mystique musulmane*, Paris, 1954, pp 153-156, where he argues that the reference to *ṣūf* as wool predates the Muslim use of the other two terms, though all three developed independently till they became interrelated in the Ṣūfī vocabulary of the 4th cent A H

17 See *supra* p 2 and fn 4

18 See L Massignon, *Lexique technique*, p 203 and *La Passion d'al-Hallāj*, Paris 1922, pp 472 and 625

19 The pertinent passages from both works are discussed below, pp 23-28

20 There is also a reference to Mānī's exposition of metempsychosis, but it is treated as a direct development of Hindu concepts which Mānī learned during his alleged stay in India See Hyderabad, pp 41-42 and Sachau I, 54-55

21 Al-Bīrūnī goes on to hint of a strain of pantheistic belief among Ṣūfīs, but the remark is too general to invite further speculation about either his sources or his intentions. See Hyderabad, p. 44, Sachau I, pp 57-58

22 H Jonas, *The Gnostic Religion*, Boston, 1958, pp 69-71

23 *Ibid*, p 83

24 See H Corbin, *Avicenna and the Visionary Recital* (trans , W R Trask), New York, 1960, pp 3-192

25 S H Barani, *op cit*, p 12 only found one instance where al-Bīrūnī, in his extant writings, acknowledged Ibn Sina, while the latter nowhere makes reference to his illustrious countrymen and fellow scientists

Note, however, the protracted correspondence recently edited by S H Naṣr and M. Mohaghegh, *al-As'ilah wal ajwibah*, Tehran, 1973.

26 The debate has been amply summarized in the article "Kursī", *Shorter Encyclopaedia of Islam*, pp 286-287 The shift in orthodox views on this topic is addressed by A J Wensinck, *The Muslim Creed*, Cambridge, 1932, p 116

27 Hyderabad, pp 66-67, Sachau I, p 88

28 See A Badawi, *Shaṭaḥāt al-Ṣūfiyā*, Pt I, Cairo, 1949, p 128, and also F Rosenthal, "The Empty Throne", *Studia Islamica* XXXI, 1970, pp 237-238 The list of references to the Throne elsewhere in the extant sayings of Abū Yazīd and other Ṣūfīs could be extended, but their function is similar to the one here selected

29 See A J Wensinck, *op cit*, p 116
Note also Hyderabad p 181, Sachau I, p 22 where al-Bīrūnī indicates his awareness of both the metaphoric and literal interpretation of the Throne

30 Hyderabad, pp 43-44, Sachau I, pp 56-57

31 Hyderabad, p 49, Sachau I, p 64

32 *Kitāb al-milal wal-nihal*, ed by W Cureton, London, 1842, vol I, p 133, *Religions partheien und Philosophen-Schulen*, trans, T Haarbrülcker, Halle 1850, pp 201-202 See also E L Dietrich, "Die Lehre von der Reincarnation im Islam" ZRGG LX (1957), p 148, fn 55 The mnemonic value of these four terms is transparent, however, they have no parallel in the schemes of rebirth worked out in Hindu religious texts

33 Sachau I, p 64

34 For a detailed exposition of the elusive Islamic references to the *mutakallim*, see S Pines, "A Note on an Early Meaning of the Term *Mutakallim*", *Israel Oriental Studies* 1, Tel Aviv, 1971, pp 224-240 *passim* but espec pp 225-228 The plural form, *mutakallimun*, appears in a technical usage once in the *Kitāb Batanjal* (Ritter, *op cit*, p 169, Pines/Gelblum, *op cit*, p 312), but the referent is equally ambiguous

35 See Margaret Smith, "Transmigration and the Ṣūfīs" *The Muslim World* 30 (1940), pp 351-357

36 See *supra*, p 9

37 The other mention of Ṣūfī doctrine in Ch 6 is too scant to merit separate analysis, see Hyderabad 47, Sachau I, 62 The purport is to stress the ethical quality of *taṣawwuf*, which al-Bīrūnī deftly conveys by describing the Divine as *al-khayr al-mahd* the Absolute Good, rather than *al-ḥaqq al-mahd*, the Absolute Truth (see *supra*, p 11) There is no value to citing this text in trying to ascertain the relation of Ṣūfism to

transmigration in al-Bīrūnī's mind, but *al-khayr al-maḥḍ* invites comparison with Vasudeva's instruction to Arjuna in the *Bhagavad Gita*, which begins *in kuntu turīdu al-khayr al-malḍa*, etc See Hyderabad, p 60, Sachau I

38 See Hyderabad, pp 52-3, Sachau I, p 69 and Hyderabad, pp 62-63, Sachau I, p 83

39 Hyderabad, pp 52-53, Sachau I, p 69

40 Vyāsa's commentary on *Yoga-sūtra* III 51 holds up as the supreme yogin the one 'who has passed beyond that which may be cultivated', i e the *Siddhis* See J H Woods *The Yoga System of Patanjali*, repr, Delhi, 1966, p 285

41 See al-Hujwīrī's analysis of the entrappment arising from *nafs* and *hawā* (*op cit*, pp 196-207), in contrast to his later emphasis on the transcendent value of *rūḥ*

42 Al-Kalābādhī (*op cit*, p 52) declares *rūḥ* to be "a light, a fragrant breath (*rūḥ*) through which life subsists, while the soul (*nafs*) is a hot wind (*rīh*) through which the motions and desires exist"

43 Hyderabad, pp 62-63, Sachau I, p 83

44 See especially the translation of Chapter 4 (pp 43 f) entitled "*The Different Opinions of Various Nations Regarding the King called Dhū al-Qarnayni or Bicornutus*"

45 L Massignon (*Lexique technique*, pp 359-412) includes excerpts from al-Sūlamī's work, but unfortunately omits the Qur'ānic verses (XVIII 84 & II 73) which al-Bīrūnī cites in the *India* as instances of Ṣūfī *tafsīr* which correlate with Hindu belief A manuscript of the full text was not available to me

46 Omitted from consideration is the minor reference in Chapter 7 to the Sūfī view of *'ishq* or love, which occurs in Hyderabad, pp 57-58 and Sachau I pp 75-76 Its purpose is to confirm and extend the value of chastity in the Indian and Greek Traditions Though al-Bīrūnī uses the term in another sense than al-Hallāj (see L Massignon and L Gardet, "Al-Halladj", *EI* IV, p 103a, where he is alleged to have perceived *'ishq* as a divine attribute of Essence), the point of his analogue is still valid, viz, that *taṣawwuf* eschews *'ishq* in the sense of passion or *hawā* since passion, as an activity of the lower soul or *nafs*, binds man to the realm of imperfection See al-Hujwīrī, *op cit*, pp 207-210

47 Hyderabad, pp 66-67; Sachau I, pp 87-88

48 See *India* II, p 289, where the source is correctly given as the *Bhagavad Gita* without further comment

49 In addition to the *Bhagavad Gita* and the *Yoga-Sūtras* of Patanjali, the book *Samkhya*, as al-Bīrūnī calls it, is frequently cited in the *India* As is the case with the *Kitāb Bātanjal*, al-Bīrūnī's text on Samkhya does not correspond with any of the classical texts relating to that school, but instead seems to have incorporated a commentary with the text and been set forth in dialogic form See Sachau II, pp 266-268

50 See *Lexique technique*, pp 97-98

51 See L Massignon, *La Passion d'al-Hallāj* II, p 643.

52 See Sachau I, pp 83 & 89.

53 See "Avicenna and Mysticism", *Avicenna Commemoration Volume*, Calcutta, 1956, pp. 209 and 215

54 See H Ritter, *op. cit*, pp 176-177 and 296

55. See *Lexique technique*, p 98

56 R C Zaehner, *Hindu and Muslim Mysticism*, New York, 1969, pp 98-99.

57 *Lexique technique*, p 98, fn 3.

58. S H Naṣr, *Three Muslim Sages*, Cambridge, 1964, p 158

59 *Supra* p. 17, fn 35

60 See, for instance, M Horten, *Indische Stromungen in der Islamischen Mystick*, Heidelberg, 1928, *Passim*.

61. See *India* II, pp 289-290, where he resorts to speculation on the origin of the Qur'ānic verse before repeating, without elaboration, the *tafsīr* as given by al-Bīrūnī.

62. See *supra*. p 23

63. Trans., pp. 194-195; Ar. text, pp. 211-212.

AL-BĪRŪNĪ, SOURCE OF INDIAN PHILOSOPHY

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1 ALTHOUGH ancient philosophic thought in India is contemporary with or even antecedent to that of Greece, and is tightly connected with old oriental thought Babylonian, Assyrian, Chinese and Persian, yet its direct sources are scanty and distorted by complications and ambiguity Legends and superstition form a big part of it, and the researcher has to add a lot in order to overcome that ambiguity and complication Al-Bīrūnī (1048) was one who had an important role in this field He took part in the Ghaznah wide expedition to India, by the beginning of the 11th century AD He had the chance to visit India more than once, and to stay there for a while, thus he was able to learn Sanskrit, the language of science and philosophy He went there at the age of fifty the age of maturity and perfection, so his education became more perfect and his understanding broader He was sincere in his studies and researches looked and listened, observed and recorded, read and wrote, analysed and compared At the same time he already had a background of the Indian culture which had been carried to the Islamic world in a direct or an indirect way [1] His aim was to verify it, nourish it and let it grow He was interested in translating, from Sanskrit into Arabic, two books illustrating the Indian thought from different aspects "*Patangal*" or "*Jukasutra*", and "*Sank*" The first book's translation was discovered by Massignon among the manuscripts of Istanbul, the second is still missing

But that was not enough for al-Bīrūnī He dedicated one of his important books to India and its culture, "*Tahqīq Ma li al-Hind min Moqūlah Fī 'al Aql aw Mardhūlah*", known among the orientalists as "The India" [2] It is considered one of the reliable sources of all branches of Indian culture history, geography, customs and traditions, literature and languages, religion and philosophy, science and art and a good deal of astronomy and astrology Inspite of being Persian, al-Bīrūnī was more attached to the Arabic language and looked at it as the only scientific language in the Islamic world of his age, contradicting, at this point his contemporary al-Firdawsī (1020), the great Persian poet of the "*Shāhnāmah*", who was dominated by a Persian tendency that made

him avoid Arabic words in his epic, as if aiming at replacing the Arabic language by the Persian in science and literature On the other hand, we can hardly find any Persian writing by al-Bīrūnī (Whatever has been ascribed to him is not quite definite) His language is clear and fluent, rising at times to a high standard, and at other times not devoid of weakness, trying his best to explain scientific ideas in a very precise and concentrated style, never rejecting any arabicized term, when necessary or more significant His scientific honesty is very much estimated as he seeks truth, away from any kind of fanaticism This is assured by the fact that he, the Muslim scientist, is writing about Brahmans and Buddhists in accuracy and sincerity, trying at the same time to defend against certain suspicions, by revealing the deviation of some Indian historians as a kind of partiality to their governors The nature of his studies being physical and mathematical sciences, affects his method, in the sense that made him fond of observations, searching for facts, examining and recording them, and doing his best to reach the sources, never content with what he hears, and always repeating the famous saying "What we hear is not like what we see" [3] In all he sees and hears, he uses his own commonsense, rejecting anecdotes and superstitions, and never chooses but what is sure and correct, though he prefers the descriptive method to the critical one, in his treating the Indian religions, he compares, balances, and relates Indian culture to Arabic and Greek In short, he is considered one of the greatest examples of his age in connecting universal cultures together Besides, al-Bīrūnī the mathematician is interested in arranging, encompassing and classifying In other words, when he handles a subject he collects its points, fixes the ideas and arranges the chapters He has an eye for the language of figures, appeals to it whenever he gets the chance It seems as if he wanted to translate every idea into figures even in his social and humanistic studies

2 We would like here to stop a little at the philosophic Indian thought from al-Bīrūnī's point of view, taking into consideration his book "*Tahqīq Mā li al-Hind min Maqūlah*" It is noticed here that in the first place, he is a scientist, and he never thought of himself as a philosopher, although he was acquainted with the philosophers and contacted them, i e , he was contemporary with Avicenna (1037), the chief of Muslim philosophers in the East, he knew him and corresponded with him They had certain discussions, but those belonged rather to the natural sciences more than metaphysics or pure philosophy At the same time he is encyclopedic, in the sense that he wanted to know everything, be acquainted with humanistic knowledge at large, studied the different schools of philosophic Islamic thought, Arabic peripatetics, theologians and ṣūfīs and how they were affected by Greek or Oriental philosophic thought Thus he could acquire a considerable philosophic culture, not void of some confusion nevertheless Above all, he is a historian, and a strict one, and could be considered one of the greatest historians of cultures in the Middle ages His two books "*Al-Āthār al-Bāqiyah*" and "*Tahqīq mā li al-Hind min Maqūlah*" prove that fact He, as a historian, is always keen to ascribe every

idea or quotation to its source, mentioning in this regard, a group of Greek thinkers seldom mentioned by other Muslim writers Most of them are antecedent to Socrates (399 B C), such as Homer (840 B C), Solon (568 B C), Thales (546 B C), Pythagoras (497 B C), Heraclitus (475 B C), Empedocles (433 B C), putting aside Democrates (361 B C) who is contemporary with Socrates, and Plato (347 B C), and Aristotle (323 B C), Galenus (201 B C), Alexander of Aphrodisias (III A D), who were often mentioned by many others. He also points to two other Greek thinkers, hardly written about Crito (IV B C) the disciple of Socrates, and Diogenes (327 B C) He quotes also from Alexandrian scholars especially Philo (54 A D), Porphyry (305 A D), Proclus (485 A D) and Johannes Grammaticus (VI A D)

The Indian philosophic thought is basically theological, always turning around theology and its connections And, as noticed in some other ancient eastern and western cultures, it starts by the idea of polytheism Every phenomenon in nature has a god, that is what Vedism says Then, the Indian thought concludes by monotheism, gathering all gods in one and from that one all the universe emanated That one is called Brahma, because he exists, and he is the only one that exists in reality He is also called "Vishnu" because he is the protector, and "Shiva", the mortifier Those were the bases of Brahmanism· concrete existents are mere imaginations, or, in other words, they are just phenomena of Brahma At this point Brahmanism reaches a form of Pantheism It considers the world as an evil which must be rejected and be purified The best who are capable of that are the Brahmans, who are placed at the top of the sectarian pyramid taught by that religion, which is characterized by two basic features Pessimism, requiring purity and sacrifice, and the strict sectarian discipline that divides society into entirely different and isolated classes It seems as if the priests of Brahmanism wanted to be masters all the time Buddhism may be considered an extension to this religion though both are contradicting They both say that existence is evil and pain The wise man is that who can strip his heart of any earthly desire Buddhism called for strict retreat and quenches every passion, and disdains life The sublime goal of man must be complete perish or "Nirvana" It is, like Brahmanism, pessimistic, but different in the sense that it calls for equality and denies class order There are also other rational Indian Schools such as "Kapila" contemporary with Plato, and like him made a complete differentiation between the body and the soul Another school is "Kanda", which said that the body consists of atoms, similar to those of Democrates. There is also the logical school of "Gautama" which tried to compose a theory of reasoning

Anyhow, it seems that al-Bīrūnī did not aim at writing the history of the various religions and sects in India or to trace their rise and development What he meant was to illustrate the mastering creed of his age Brahmanism It was to him the axis of all other sects [4] He hardly handled any other sect except Sunnia, known in the Islamic World by denying prophecies, and contradicting

Brahmans, except in certain views, it may be nearer to Manichaeism[5] In his talk about Brahmanism he describes its rites, customs and ranks, and treats the factors that affected it, pointing to its relation with Greek and Persian thought, Zoroastrianism in particular, and compares some of its ideas with what is similar in Greek thought[6], revealing how its priests were keen to conserve their race, never mingling or marrying with the other classes, sticking to a special "regime" in eating and clothing they eat only twice a day, at noon and in the evening, and beef is tabooed[7] They are characterized by a certain uniform a waistband which they use since childhood, and a red robe They let loose their long oiled hair[8] and look at themselves as the elite of the human race, because they emanate from what is most sublime in Brahma himself[9] Thus, they are broad-minded, calm hearted, sincere in their wisdom, preferring justice and loving worship[10] Below them, in place, comes the hierarchy of noblemen, soldiers, peasants and professionals Away from any criticism or commentation, al-Bīrūnī narrates the legends, related to those classes, and the distinction of one over the other[11]

3 Al-Bīrūnī was interested in treating their ideas and theories, and we would like here to make emphasis on three of them the idea of divinity, rational and sensuous beings, and salvation

A *The idea of divinity* Brahmans conceive God as one, everlasting and infinite, willing in his deeds, able and sage, living and make-living, not like any other thing, and no other thing is like him, pure good, supremely elevated in rank not in place, His science is eternal, eternal because casual knowledge requires antecedent ignorance which is impossible, for his knowledge is antecedent to time itself, and is completely different from that knowledge of scientists and sages[12] He is a speaker too, for as a matter of fact, that who knows must talk, and he actually talked to the ancestors in different ways, sending a holy book to some of them, and inspiring others with fruitful and useful thoughts And although he is absent from the senses, he is conceived by the soul and his attributes are comprehended by the commonsense (understanding) That is pure worship, and sticking to it enables one to achieve happiness[13]

The providence of God is universal, i e it is not confined or restricted to a particular class, but people only remember Him in their time of need, and soon forget Him the moment they are out of it His deed is either direct or through an intermediate, and all the active forces come from the soul That is the belief of the upper class, as for the commons, they go as far as anthropomorphism and corporeity[14]

Thus, it is evident that al-Bīrūnī counts the Brahmans among monotheists. That is true, as we have seen before, in the sense that they gather all the gods in one, that is Brahma But that monotheism is neither pure nor absolute It is rather mingled with polytheism, for, as mentioned before, that god is

"Brahma" because he exists, and "Vichnu" the protector, and "Shiva" the mortifier, and after all, he gets mixed with the world he created First he started as one, then he felt a desire to multiply, so he created light through which he created water, and through water he created the earth [15] That is a sort of emanation which would be adopted by Plato The monotheism of the Brahmans develops into something very similar to the pantheism It is probable that al-Bīrūnī, in this respect, was affected by Islamic theologian studies in his trying to illustrate the Brahman idea of divinity, although he referred to Indian sources, specially the forementioned "*Putangal*" and "*Sank*" It suffices here to refer to his talk about the two attributes of the divine science and speech, and their relation to each other, the latter being the topic of many discussions in Islamic thought

B *Rational and sensuous beings* Al-Bīrūnī dedicated a whole chapter of his book "*Tahqīq Mā Li al Hind min Maqūlah*" to that subject He is interested here to relate Indian views to their equivalents of Greeks and Muslims or of Christians and Jews, and that is another proof of his wide knowledge and broad understanding He noticed that the Indian thought, the same as the Greek, passed through successive stages, starting as sensuous, and gradually elevated to the spiritual and abstract even gods themselves were first given a concrete illustration, the common class is still sticking to something like that [16] From his own point of view, it was the Brahmans who extended the rational and spiritual trend They ascribed everything to a supreme power which provided them with the different concepts and universals, such as fire, light, water and earth This power also includes form and matter, human soul, the principal elements, the perceptive senses, and the active valuation Those universals tower up to 25, and all kinds of knowledge are restricted to them So they ought to be thoroughly, practically and minutely known and studied And it is said, "know them, then adhere to any religion you like for you will reach salvation" [17]

All that makes us wonder whether the Brahmans call for an ontological idealism, similar to that of Plato, considering the concrete world as forms and imitation of the world of ideas In other words, concrete matters do not really exist, they are just fancies Anyhow, al-Bīrūnī did not call that "idealism" although one could feel it in his writing, for as we mentioned before, he was well known as a historian, not a philosopher However, Brahman idealism is a fact, it was extended by "Buddha" (5 B C) inspite of his contradiction to Brahmanism, for after all he was brought up as a Brahman He called for an epistemological idealism, similar to that of Kant who looked at the Phenomena as mere conception He believed only in the intellect and intellectual laws As for Buddha, he exaggerated his idealism to the extent that he denied the perceptive essence itself To him, the emotional phenomena are independent in themselves, appearing and disappearing without relying on a perceptive essence which thinks and understands In short, the whole universe is but a series of phenomena, each one succeeding the other

C *Salvation* "The whole world is evil" is an old Indian idea, adopted both by Brahmans and Buddhists, but nobody could decide whether it was indigenous or imported What concerns us here is that it was a "semi-belief" adopted by the upper class and the commons and was the axis of their behaviour and their attitude towards life . "That who is experienced in this world would know that its good is evil and its comfort is impossible" [18] This is evident, to them, in the multiplicity of the world and its variations in multiplicity there are many contradictions, and in variation there are cessation and alteration The permanent and everlasting is always good To prove this evil they narrate many events and phenomena Brahmans like many moderns, such as Schopenhauer (1860 A D) are pessimists Moreover, the range of their pessimism is farther and more dangerous, for it is not restricted to a certain individual or a particular philosophy It is dominating over the public and mastering general behaviour Indian idea of salvation is tightly connected with it

Consequently, the world, being an evil, should be rejected, and that could be attained through certain retreat and immolations, the former being more sublime than the latter These retreats, in turn, vary in degree, the lowest of which is ascetism which is a necessity that should be adhered by all the people, old and young After ascetism comes knowledge It fills the soul with peacefulness, and liberates it from its fetters that tie it to the world, owing to its ignorance The moment it knows and comprehends, it attains a thorough acquaintance with things away from any suspicion, and at this moment it will realize that the things it has already looked at as good and delight is but evil and distress [19] Knowledge must not be superficial We should appeal to meditation which would abstract us from our visible characters, penetrate the depths and change us from a natural state into an unnatural one That has since long been called "Yoga", which in reality is not mere physical exercises It is rather a way of organizing the thought, and a domination over the soul and distracting it from its worldly desires, and directing it towards the permanent truth Brahma, delivering us at the end, to complete perish, "Nirvana" However, the term Yoga is not directly mentioned by Bīrūnī in his writings, although he expressed its significance when he said "The way to salvation is to acquiesce the soul to control the senses from outside into the inside",[20] so nothing occupies the mind except Brahma" [21]

Complete perish, or "Nirvana" is genuine happiness, or else the soul will be wandering in migration from a body to another, exactly as changing a robe with another, or as a cosmos moves from a constellation to another And it is said Everything that is born is destined to die, and everything that is dead is returning back [22] This is the transmigration which is well known in Indian thought In this respect, al-Bīrūnī states that if the "*Shahādah*" is the motto of Islam, and the Trinity the symbol of Christianity, and the Sabbath is that of Judaism, transmigration of souls is the symbol of Indian sects [23] The belief in this idea is an evocation of courage, devotion and sacrifice for duty and truth

In fact, and inspite of the phenomena of death, the soul is eternal It wanders from a body[24] to another, owing to its circumstances if it is miserable it changes the human body with an animal or a plant Those successive journeys continue until it is perfectly purified and elevated to the level of complete perish [25]

Accordingly, the idea of salvation is not a mere rite of physical worship It is rather a philosophy aiming at deliverance and redemption It depends on soliloquy and meditation Al-Bīrūnī made a great stress on this idea and quoted from various texts,[26] pointing at the same time, to its equals in Islamic Ṣūfism, taking from al-Shiblī (945 A D) his own words "Let away everything and you will find all things", and from al-Bustami (874 A D.) "I shed off myself as a snake casts off its slough, then I look into my soul, and I was Him" [27]

We have already referred to the fact that al-Bīrūnī's book "*Taḥqīq*", contains various kinds of Indian culture, but only one of them is treated here, and in small limits However, we hope that this valuable book would be carefully studied, comparing the facts it contains with the results of modern researches in the history of Indian culture, which has certain links with ancient and modern cultures Its relations with all sorts of Islamic cultures (science, literature, philosophy and ṣūfism) are clear and tight Those relations have anciently attracted the attention of Islamic-thought historians, such as Ibn al-Nadīm in "*al-Fihrist*", and al-Shahrastānī in his "*al-Milal wal nihal*" [28] The same subject has been treated from different angles by modern researchers They compared the theory of the atom in Islam, with its equivalents in Indian thoughts On the other hand they compared Islamic ṣūfism with Indian ṣūfism They also treated the idea of denying prophecies, and traced it back through some Indian sects We can sincerely rely on the writings of al-Bīrūnī, as a resource and a guide to all those sorts of studies

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2 First issued in Leipzig in 1878 by Sachau and reissued without any further additions in Hyderabad in 1958 Translated by Sachau in 1879 Still theArabic texts lack verification and more perfect translation, will be hopefully included in the project of reviving al-Bīrūnī's books decided lately in Teheran's Conference (September 1973)

3 Al-Bīrūnī *Tahqīq* Hyderabad 1958, p 1

4 Al-Bīrūnī *Tahqīq* (p 129)

5 Al-Bīrūnī *Tahqīq* (p 456)

6 Al-Bīrūnī *Tahqīq* (pp 452 & 455)

7 Al-Bīrūnī *Tahqīq* (p 76)

8 Al-Bīrūnī *Tahqīq* (p 77)

9 Al-Bīrūnī *Tahqīq* (pp. 77—79)

10 Al-Bīrūnī *Tahqīq* (p 20)

11 Al-Bīrūnī *Tahqīq* (p 21)

12 Al-Bīrūnī *Tahqīq* (p 22)

13 Al-Bīrūnī *Tahqīq* (p 21)

14 Al-Bīrūnī *Tahqīq* (pp 23 & 29)

15 Al-Bīrūnī *Taḥqīq* (p 30)

16 Al-Bīrūnī *Tahqīq* (pp 24 29)

17 Al-Bīrūnī *Tahqīq* (p 34)

18 Al-Bīrūnī *Tahqīq* (p 60)

19 Al-Bīrūnī *Tahqīq* (pp. 51-52)

20 Al-Bīrūnī *Tahqīq* (p 58)

21 Al-Bīrūnī *Tahqīq* (p 40)

22 Al-Bīrūnī *Tahqīq* (pp 51-52)

23 Al-Bīrūnī *Tahqīq* (pp 51-52)

24 Al-Bīrūnī *Tahqīq* (p 39)

25 Al-Bīrūnī *Tahqīq* (pp 45, 50)

26 Al-Bīrūnī *Tahqīq* (pp 51, 67)

27 Al-Bīrūnī *Tahqīq* (pp. 66-67).

AL-BĪRŪNĪ'S CREEDS AS DEPICTED IN HIS WORKS

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PAKISTAN may be justified in claiming the fifth century scientist, Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī, as her own distinguished son On the authority of the famous historian, Ibn al-Āthār Ibn Abī Usaybo'ah and al-Qalqashandī definitely ascribe him to Bīrūn in Sind - a city near the old city al-Manṣūrah Al-Bīrūnī himself, however, states that he was born in Khwārizm-shāh on Thursday, the third of Dhū al-Hijjah in 362 A H As he gives no clue as to why he was called al-Bīrūnī, it may rationally be assumed that one of his forefathers might have left the famous city of Bīrūn near al-Mansūrah and got himself settled down at al-Khwārizm Hence, Abū Raiḥān was given the epithet of al-Bīrūnī Al-Sam'ānī and Yāqūt's statement that Abū Raiḥān was called so because he was born in the vicinity of Khwārizm is not at all convincing in as much as a great many scholars hail from the vicinity of Khwārizm and none other than Abū Raihān is called al-Bīrūnī Of course, it is sometimes mentioned that the geographical works in our hands are silent about the existence of Bīrūn in Sind Hence, a number of scholars have suggested that Bīrūn seems to be a mistake for Nirūn, the ancient name of modern Hyderabad But Hājjī Khalīfah also insists on its ascription to al-Bīrūn Again, we cannot totally disregard the following assertion of al-Qalqashandī

(Vide Subḥ al-'Ashā, Vol V, p 64)

ومنها البيرون قال في اللباب بكسر الباء الموحده و سكون الياء آخر الحروف و ضم الراء المهملة و بعدها واو و نون في الآخر، و هي مدينة من اعمال الديبل بينها و بين المنصوره و اقعة في الاقليم الثاني من الاقاليم السبعة، قال في "القانون"، حيث الطول اربع و تسعون درجة و ثلاثون دقيقة — و العرض اربع و عشرون درجة و خمس و اربعون دقيقة،

قال ابن سعيد و هي من فرض بلاد السند التي عليها خليجهم المالح الخارج من بحر فارس قال في "العزيزى" واهلها مسلمون، و منها الى المنصورة خمسة عشر فرسخا ،

قال ابن سعيد و اليها ينسب ابوالريحان البيروني ، يعنى صاحب "القانون" في اطوال البلاد و عروضها ـ و منها المولتان . . . وهي مدينة من السند فيما ذكره ابو الريحان البيروني ، و ان كان ابن حوقل جعلها من الهند و عليه جرى في "مسالک الابصار" لان البيروني اقعد بذلک منه ، لان السند بلاده فهو بها اخبر ، واقعة في الا قليم الثالث من الاقاليم السبعة ـ

"One of the cities of Sind is al-Bīrūn, Al-Lubāb contends that the word Bīrūn is with the Kasrah of al-Bā', *sukūn* of Yā', the last letter (of the alphabets) with *dammah* of Rā' which is followed by *wāw* and *nūn*, a town in the government of Daibul and is situated between al-Daibul and al-Manṣūrah in the second *iqlim* out of the *seven aqālīm* Its longitude has been stated in al-Qānūn as ninety-four degree and thirty seconds, and the latitude twenty-four degree and forty seconds

Ibn Sa'īd says, Bīrūn is one of the prominent cities of Sind situated on their bay that flows down from the Persian Gulf Al-'Azīzī contends that its inhabitants are Muslims and that it is at the distance of fifteen *farsakh* from al-Manṣūrah Ibn Sa'īd adds that to this town is ascribed Abū al-Raiḥān al-Bīrūnī, author of al-Qānūn which is on the longitudes and latitudes of cities One of the cities of Sind is Multān, as has been mentioned by Abū al-Raiḥān al-Bīrūnī Ibn Hawqal, however, states that it belongs to India, and the same has been mentioned in the *Masālikat al-Abṣār* But al-Bīrūnī is more reliable than Ibn Hawqal, as Sind is his country and is well-informed about it Multān is placed in the third of the seven *iqlims*"

The works of al-Bīrūnī have preserved very valuable and authentic information concerning the Brahmanical religion of the people of India In the time of al-Bīrūnī Khwārizm had developed into a great centre of Muslim as well as non-Muslim learned savants The Zoroastrians, Manichaeans and Brahmans had found a peaceful shelter in al-Khwārizm The fact that al-Bīrūnī had rendered two Sanskrit works - *Scnk* and *Patanjali* into Arabic would have us believe that he had learnt the Sanskrit language before he visited India Contrary to the statement of al-Bayḥaqī and al-Shahrazūrī (vide extract's quoted in *al Āthār al Bāqiyeh* pp L II, L III) his sojourn in India did not last long At best his stay in the subcontinent according to some Indian scholars (vide the article of Mr J S Mishra *New light on al Bīrūnīs stay and travel in India*, Central Asiatic Journal, Vol XV No 4, 1972) "could not have exceeded two years i e between 1027-28 and 1028-29 A D"

Al-Bīrūnī has recorded very valuable information about the non-Muslims but has nowhere or seldom dealt with anything relating to himself. His accounts about his own family and his early life are hardly traceable One can, however, estimate some of his achievements and creeds in the light of his writings His book on the history of Khwārizm would have been of great help But it is unfortunately not available and its extracts preserved in the work of al-Bayhaqī are too inadequate The aim and object of this short paper is to deal with his creeds and doctrines as depicted in some of his works that have survived

Belief in Allah's Creation Al-Bīrūnī believes that it is Allah Who has for the first time created the inanimate and taken care of its upbringing and continuity Allah, the Exalted, says (al-Ra d 17) "He sendeth down water from the sky so that valleys flow according to their measure and the flood beareth (on its surface) swelling foam from that, which they smelt in the first in order to make ornaments and tools riseth a foam like unto it Thus Allah coineth (the similitude of) the true and the false Then, as for the foam, it "passeth away as scum upon the backs, while, as for that which is of use to mankind, it remaineth in the earth Thus Allah coineth the similitudes"

Al-Bīrūnī states, "the Indians believe that the water precedes everything in creation It is through water that it is possible to cause condensation, growth and stability in everything which is adorned with spirit Water is a tool, an apparatus which enables the artisan to produce his art in a material object The Revelation indicates its importance Allah, the Exalted says (Hud 7) "and His Throne was upon the water" - whether the expression is applied to a particular object bearing the name mentioned in the verse, or is interpreted for an angel or the like, the meaning is clear that at the time under reference there was Allah and nothing other than the water and His Throne" (Al Bīrūnī *India* p 181)

Al-Bīrūnī further says that when Allah wanted to create mankind, He caused the earth to be condensed to remain outside its natural form i e truly globular A portion of the earth thus arose out of the water causing it to squeeze towards the lower part which was called the sea The water of the sea is saline so that it escapes putrefaction, which might destroy mankind, as it has been mentioned by Theodore Abū Qurrah The saline water also produces treasures which are needed by men and animals both of which can only live on sweet water which is far from the place of water Allah has, therefore, subjugated the Sun and the Moon to play their roles respectively and entrusted them to move the water, warm it, evaporate it and lift it to the high heaven The elevation of some portion of the earth out of the water mixed the dust, air and water to produce a composite temperament thereof. Now, the composition could not materialize without heat The movement of orbits, however, heated the air in the surrounding sphere which in its turn caused the stars to revolve and drove the heat to the centre spreading it far and wide in different proportion, causing change and various moods just to possess time and circles. The wind was then

used to evaporate the water into clouds, and to drive them to distant parts having no drop of water to rain over them and to give life to the living beings of those parts, to grow vegetation, and to cover mountain peaks with snow and glaciers which cause streams running back to the seas through the dwellings of mankind and quenching the thirst of animals and lands

Al-Bīrūnī has a firm belief in the Qur'ān and the sayings of the Prophet Concerning the fasting-duration he, for example, asserts in accordance with the verse

وكلوا و اشربوا حتى يتبين لكم الخيط الا بيض من ا لخيط ا لا سود من الفجرثم
اتموا الصيام الى الليل—

(al-Baqarah 187) " and eat and drink until the white thread becometh distinct to you from the black thread of the dawn Then strictly observe the fast till nightfall " that Allah has limited the duration of the fast with the appearance of the dawn specifically But he has not specified the end of the fast with, for example, the end of the day or the beginning of the night, and has only mentioned the night which is known to the people without exception as the disappearance of the disk of his Sun (*Cf al-Athār al Bāqiyah p* 7)

ولكنه تعالى لما حد اول الصوم بطلوع الفجر ولم يحد آخره بمثله بل اطلقه
بذكر الليل فقط يعلم الناس بأسرهم انه غروب قرص الشمس .)

In other words he does not consider "the appearance of the dawn" the beginning of the day nor the "disappearance of Shafaq, red horizon, the end of the day, as has been construed by some Shī'ites (cf Ibid p 8)

(فلو كان طلوع الفجر اول النهار لكان غروب الشفق آخره وقد اضطر الى قول
ذلك بعض ا لشيعة)

Thus, the discourse leads us evidently to think that al-Bīrūnī in no way associates himself with any particular sect of Islam

Referring to the sight of the moon as determining factor of a particular month which may be perfect (consisting of thirty days) or imperfect (consisting of twenty-nine days), al-Bīrūnī advises us to follow the ḥadīth strictly

"صوموا لرويته و افطروا لرويته"

You fast on seeing the moon (of the month of Ramazān) and break your fast as you see the moon (of the month of Shawwāl) He clearly asserts that according to the usual calendar it is not correct to fast same day or break fast on one and the same day all over the world, as the latitude and longitude of countries differ widely He, therefore, appreciates the Ḥadīth

انه عليه السلام قال نحن قوم اميون لا نكتب و لا نحسب—الشهر هكذا و هكذا وكان يشير في كل واحدة منها باصابعه العشر يعني تاما ثلثين يوما ثم اعاد فقال وهكذا و هكذا و حبس ابهامه في الثالثة يعني ناقصة تسعة و عشرين يوما فنص عليه السلام نصا لا تخفى على احد ان الشهر يكون تاما مرة يكون ناقصا اخرى و ان الحكم جار عليه بالروية دون الحساب لقوله لا نكتب ولا نحسب ۔

The Holy Prophet said, "We are an Ummī people, we do not write, nor calculate The month is such and such," and he pointed to his ten fingers meaning a perfect month of thirty days Then he repeated and said, "and such and such," and he withdrew his thumb in the third time, meaning an imperfect month of twenty-nine days Hence, the Prophet has categorically made it clear without any shadow of doubt that sometimes a month is perfect and sometimes imperfect, and that the decision will be given after seeing and not after calculation, as is understood from his words "*lā naktubū wa lā Nahsibū*"

This explanation of al-Bīrūnī determines the meaning of "Ummī", concerning which there has been recently a lot of controversy without any rhyme or reason, some arguing that the word is an attributive of 'umm' referring to "Ummul-Qurah" meaning 'Mecca the mother of cities' or 'original city' and 'illiterate' The hadith mentioned by al-Bīrūnī clearly explains the word "Ummayyūna" with "*lā naklubū walā nahsibū*" making the secondary meaning as the primary one i e 'illiterate' Al-Bīrūnī further speaks about the Arabs in the following words

(cf *al-'Āthār*, p 336) وكانوا اما سا اميين لم يمكنهم معرفتها الا بشئ يعاين

"Unlike the Indians the Arabs were 'ummī' who could not learn the changes of atmosphere and seasons and the various climatic changes of the year except a thing that is observed" Thus, al-Bīrūnī has no doubt in believing that the Arabs in general did not acquire the learning of the Jews and the Christians The Qur'ān also insists on the point that traditionally the Arabs did not care for achieving knowledge and the Messenger of Allah also had no occasion to learn the sciences and the learnings the Christians and other nations of the period were abreast with

In the light of the writings of al-Bīrūnī it can be safely said and that too in agreement of what Doctor Salīm Krenkow of Germany has stated in his colophon published at the end ot al-Bīrūnī's *Kitāb al-Jamāhir*, as he says

و ايضا نحقق اول مره من هذا الكتاب ان البيروني سني المذهب، لانه ذكر الشيعة مرتين كانهم ناس ليسوا في البلاد التي هو فيها ۔

"We also assert for the first time on the basis of this book that al-Bīrūnī was a Sunnite in his creeds, as he has mentioned the Shī'ites twice in this book as though they were not in the country al-Bīrūnī hails from (Vide Ma'ṣūmī, *al Bīrūnīs Devotion to the Qur'ān*) Moreover, al-Bīrūnī has mentioned the Zaidites and some other sects of the Shī'ites with his sincere prayer to Allah that they may follow the righteous path (Cf *Al-Āthār al-Bāqiyah* pp 64-68, p 8).

THE ATTITUDE OF AL-BĪRŪNĪ TOWARDS SCIENCE AND EDUCATION

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FOR a considerable time, scholars have sought to study the underlying reasons which gave Muslim culture and civilization the prestigious position that it occupies in the history of mankind The efforts which have been deployed in this regard have certainly been tremendous and I have often met the highest standards of scholarship, the thorough and systematic study of Muslim history, relics of all sorts and Muslim institutions and ideas are proof of the great interest that modern scholarship has in the Muslim heritage

Yet, in modern times, an insistent demand has been made, especially by Muslim scholars, to review, and eventually re-write, Muslim history This demand is often made either as a result of an inherent dissatisfaction with what has thus far been written on the Muslim heritage, due to some tendentious or superficial writing by some scholars, or, with a view to encourage further and deeper study of that heritage

I propose that a re-appraisal of the Muslim heritage is justified mainly on the ground that most of what has been written thus far, has left almost untouched the moving forces underlying Muslim culture and civilization, we still read of the Arab Muslim "miraculous" upsurge from a state of relative barbarism (Jāhilīyah) to a position of leadership in almost all fields of civilization and culture The dissatisfaction which is generally felt with the reasons thus far given for this upsurge explains the use of the adjective, "miraculous", often used in this context

Some scholars have attributed this upsurge mainly to the drive of the new faith, i e , Islam It is our contention that it is in the new institutions, in addition to the new *weltanschauung* which Islam brought forth, that a more satisfactory explanation must be sought Such institutions which have become standard terms of reference, as "tribe", "family", "mosque", "teacher", "student", "judge" etc have meant slightly, sometimes widely, different things in the course of time.

Indeed, the study of the developing meaning of those "terms of civilization" must occupy a far greater place in our scholarly efforts, for unless such studies are undertaken, one is apt, while using these terms, to fall into dangerous anachronisms

On the other hand, this undertaking is particularly significant today for two main reasons First, because Muslim scholars, especially those who have been educated in the western tradition, tend to impose on Islamic institutions, and terms of reference, western connotations by drawing parallels between Muslim and non-Muslim—mainly western concepts This is sometimes done with such noble motives as seeking acceptability of Muslim concepts among modern Muslims, or introducing these concepts to western readers This procedure, besides being scientifically incorrect, is also very dangerous, for it denatures Muslim culture in the process of interpreting it

Second, because we are witnessing today a general re-evaluation of modern civilization which revolutionizes the role of science, technology and education in modern society, it is necessary, under these circumstances, to have an accurate understanding of the terms of reference in our heritage in order to preserve its precious qualities

I make this preliminary observation in order to warrant the study of the attitude of al-Bīrūnī as an *'ālim* and educator, on the occasion of his millenary celebrations

It is not possible to find in the works of al-Bīrūnī a systematic discussion of education, this has not been one of his chief concerns Yet, in the true tradition of a man of science, he had a keen observation of almost every aspect of the society in which he lived It is, therefore, through the introductory remarks to his scientific studies that he exposed his ideas on the subjects of *'ilm*, *'ālim*, the methods of acquiring knowledge, and on education generally

In this essay, an attempt has been made to classify and comment on these ideas drawing mainly on his book on India, the *Patanjali* and the introduction of his book *Nihāyah al-amākin*

The overall picture that is drawn from this study denotes an attitude of mind among the great Muslim classical scientists the understanding of which is indispensable for the proper appreciation of Muslim civilization in its heyday

It is remarkable that the starting point of every Muslim *'ālim* is his profound belief in the great wisdom of God as exposed in his worldly creation This attitude is shown, in the case of al-Bīrūnī, in his repeated reference to the verses of the Holy Qur'ān "And contemplate the (wonders of the) creation in the Heavens and the Earth", "Our Lord, Not for naught hast Thou created

all) this " (Surah 3. 191). "This noble verse contains the totality of what have explained in detail " says al-Bīrūnī in the introduction to *Nihāyah l-Amākin* [1] Indeed, all scientific pursuits, in the final analysis are intended to trengthen belief in God and to enable man to better appreciate the graces which Ie bestowed on mankind It is not as a result of mere usage that all Muslim riting, speech and action start with the verse "In the name of God the eneficent, the Merciful"

Al-Bīrūnī does not hesitate to set the service of religion as the main aim f his scientific activity [2] If such is the aim of science, a guarantee is given gainst its misuse to serve ignoble purposes which human nature might be empted to pursue Science, thus, draws its ethics from Islam Al-Bīrūnī bhors the use of science to mislead or harm and warns against "the sciences hich prey on the ignorance of people" [3]

Knowledge is not acquired only to seek God's pleasure, and to achieve a umber of worldly benefits, equally important is the "confidence and security" hich it engenders among its possessors [4] For there is no worse source of security and degradation than ignorance [5]

Another significant consequence of knowledge is the help it provides to ople to know and appreciate each other Al-Bīrūnī's admiration for some pects of Indian culture was the result of his study of that culture, and it is with e specific aim of establishing a fruitful dialogue between the thriving Muslim lture and the old and prestigious civilization of the Indian sub-continent, at he undertook to write his valuable book on India In the introductory apter of this book, al-Bīrūnī says, "(One of my friends) incited me to write wn what I know about the Hindus as a help to those who want to discuss ligious questions with them, and as a repertory of information to those 10 want to associate with them "[6] In his book on India, al-Bīrūnī devoted veral chapters to expose the different religions which he studied, establishing rallels among them, and between them and Islam This endeavour makes Bīrūnī the founder of the comparative study of religions

Finally, knowledge generally, but scientific knowledge in particular, is to Bīrūnī that which distinguishes man from other living creatures, it brings th good and hopes to avoid evil If science should ever fail or mislead, this he result of our own ignorance which sometimes blurs the clear vision of the n of science

Since scientific knowledge is very essential to determine the quality of a n's life, what are the conditions that al-Bīrūnī considers essential for its uisition?

There is no condition for the acquisition of knowledge more important in

al-Bīrūnī's view than tolerance His advocacy of open-mindedness, resilience and similar qualities which he considers essential for a true man of science, stem from his basic attitude of tolerance It is this tolerance which helps him appreciate the viewpoints of other men of science irrespective of their religious beliefs or political affiliation, and while he appreciated some aspects of Hindu culture, he did not, however, hesitate to condemn many of the Hindu practices which were essentially in contradiction with scientific thinking as well as Islamic beliefs It is with this critical spirit that he wrote his book on India and translated into Arabic, standard works of Sanskrit literature In this regard "he never had a successor before the days of the Emperor Akbar" [7]

Another aspect of al-Bīrūnī's scientific attitude is his objectivity Undoubtedly, he found many objectionable practices among the Hindus These practices he recorded with remarkable objectivity drawing the attention of his readers to the fact that the act of recording these practices must not be interpreted as a sanction or approval He says, "If the contents of the quotations (from Hindu texts) happen to be utterly heathenish, and the followers of the truth i e the Muslims, find them objectionable, we can only say that such is the belief of the Hindus, and that they themselves are best qualified to defend it" Referring to his book on India he says, "This book is not a polemical one I shall not produce the arguments of our antagonists in order to refute such of them as I believe to be in the wrong My book is nothing but a simple historic record of facts "[8] Sachau comments on this quotation by saying that al-Bīrūnī "will not convert Hindus, nor lend a direct help to missionary zealots He will simply describe Hinduism, without identifying himself with it"[9] It is this same impartial and humble spirit, so characteristic of a true man of science that makes al-Bīrūnī say, "I, for my part, do not know what I am to say about these things (meaning, Hindu practices), since I do not believe in them" [10] It is with this spirit that al-Bīrūnī wrote twenty books on India some of which are still unknown [11]

This of course, does not mean that he was not critical in his observations; "whenever he suspects humbug, he is not backward in calling it by the right name Thinking of the horrid practices of Rasayana i e the art of making gold, of making old people young etc , he bursts out into sarcastic words " [12]

Once knowledge is objectively acquired, it must be recorded with clarity and accuracy Al-Bīrūnī speaks of "the crime of translators"[13] who misconstrue ideas while translating from one language to another

Finally, knowledge, says al-Bīrūnī, must be shared with other men of science. This sharing of knowledge is imperative, not only because of the benefits that ensue but also because it is the natural obligation of the man of science towards his fellow scientists This sharing of knowledge must be as natural as the instinct of "some species of birds that feed on fish (to) share their catch".[14]

Two important ideas draw particular attention in the study of the attitude of al-Bīrūnī to the acquisition of knowledge First, is his contention that man has an instinctive tendency to acquire knowledge "[15] "I say, further," he says, "that man's instinct for knowledge has constantly urged him to probe the secrets of the unknown, and to explore in advance what his future conditions may be, so that he can take the necessary precautions to ward off with fortitude the dangers and mishaps that may beset him' [16] This quotation denotes the utilitarian as well as the instinctive urge that forces man to acquire knowledge. It also reminds us of the attitude adopted by some modern philosophers who see the whole activity of thought as a response to a need.

Second, is al-Bīrūnī's urge to men of science to investigate unknown grounds His own scientific pursuits are a clear example of this attitude He is willing to accuse of ignorance the scientist who does not seek untrodden paths "But surely", he says, "there is a great difference between an investigator of truth and a follower of tradition God says, "Are those equal, those who know and those who do not know" [17] Only those who are "investigators", deserve the name of "those who know", whereas the "followers of traditions" are referred to in the Qur'ān as "those who do not know"

These two ideas are summarized by al-Bīrūnī in the following words' "knowledge (is acquired) by the grace of God and the determination of man to know by means of the stars and other creations "[18]

The references which al-Bīrūnī makes to education are casual they come in the context of his observations on the manners and customs of India' But although he did not reflect extensively on this subject, yet, some of his observations and general attitude deserve to be especially noted

As a mathematician and astronomer he gave these two subjects the highest place in the education of the man of science But, he also referred to several other subjects which he considered necessary in an educational curriculum

Of particular significance are his ideas on the importance of the study of languages Since the study of languages helps to acquire first-hand information, al-Bīrūnī insists on proficiency in languages other than one's own mother-tongue As a non-Arab who presumably had to learn Arabic at a tender age, he insisted on the importance of learning Arabic He looks at this, not only from the point of view of a Muslim, but also as a man of science whose knowledge would be inadequate if he had not studied the language of the civilization of his age The Persian might say, 'I do not need Arabic at all' This discourse, says al-Bīrūnī, " . is truly relative to himself only, but not absolutely" [19] He also insists that this knowledge of language must not be confined to an oral proficiency but must include the ability to write in that language, for it is "the art of writing (which) spreads news over space as the winds spread, and over time as

the spirits of the deceased spread Praise be therefore unto Him Who has arranged creation and created everything for the best"[20]

In addition to the exact sciences and the study of languages, al-Bīrūnī gives special importance to the teaching of history and geography Geography, he often mentions in the context of geometry, for it is in geography that some geometrical calculations and measurements find their practical application

On history, he has some interesting reflections, to him, history is nearer to story-telling than to a scientific discipline "Also affluent people", he says, "find relaxation and comfort on listening to news and gossip told by night, after they have become bored by their amusements It is for this reason that histories were written, and stories of ancient peoples and lands were narrated The latter, however, exist in the present, and the former is not in it, therefore the latter is of superior interest"[21] Yet in another place, al-Bīrūnī says it is the history of peoples which accounts for the differences among them, the radical difference between Muslims and Hindus are explicable only "by the history of India and the peculiarities of the national character of its inhabitants[22] Al-Bīrūnī, therefore, was not consistent in his appreciation of history considering it sometime, a mere pastime and at times, a serious discipline

Al-Bīrūnī shows great regard for the study of one's heritage and social customs He admires the Hindus who make sure that their children are thoroughly versed in the manners and customs of their own people

From these rapid references we may deduce that in addition to the study of religion, al-Bīrūnī's educational curriculum includes primarily the exact sciences, the study of languages, geography and history As for the manners and customs of one's own society, their transmission is the responsibility of the parents One notices the absence of the arts in this curriculum

Two specific references to teaching method and teaching aids are mentioned in al-Bīrūnī's book on India First, is his observation that learning is primarily "the fruit of repetition" and his attack on "verbosity" "His professional zeal", says Sachau, "and the principle that learning is the fruit of repetition, sometimes induce him to indulge in repetitions, and his thorough honesty sometimes misleads him to use harsh and even rude words He cordially hates the verbosity of Indian authors and versifiers, who use lots of words where a single one would be sufficient"[23]

The second observation refers to the use of black tablets by Hindu children We know that tablets were in use for teaching purposes as early as Omayyad times, but both the use and colour of these tablets were different from those used by Hindu children "The Hindus", al-Bīrūnī says, "use black tablets for the children in the schools, and write upon them along the long side, not the broad side, writing with a white material from the left to the right" One would think that the author of the following verses had meant the Hindus

"How many a writer uses paper as black as charcoal,

"By writing he places a bright day in a dark night,

"Weaving like a weaver, but without adding a woof"[24]

One final remark may be in order, that al-Bīrūnī's main interest in mathematics and astronomy has not detracted his attention from almost every other field of knowledge known to his day, making him a prototype of the encyclopedic scientist of the Middle Ages

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2 In the *Nihāyah* he says that his study is undertaken because it is essential to determine the direction to which a Muslim must turn his face during prayers, i e, the *qiblah* Cf Ali, *op cit*, pp 10-11 In another place he refers to the importance of mathematics to "enable people to check the amount and area of possessions" *Ibid* p, 4

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12 Ibid, p XXI

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18 Ibid, p 9

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AL-BĪRŪNĪ AS PHILOSOPHER

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IN the context of classical Islamic civilization the name "philosophy" (*al-falsafah* or *al-ḥikmah*) is reserved for a particular set of disciplines associated with the well-known schools of "Islamic philosophy" such as the Peripatetic (*mashshā'ī*), Illuminationist (*ishrāqī*) and the like, and not other schools, like theology (*kalām*), which often deal with philosophic ideas but are not officially recognized as "philosophy"[1] Therefore the title of "philosopher" (*al-faylasūf*) is usually reserved for those who are masters of the doctrines of one of these "philosophical" schools with all the different ramifications and nuances that various branches of these schools contain Considered in this light al-Bīrūnī has never been classified by classical authors as a "philosopher", nor associated with one of the well-known schools of traditional Islamic philosophy But if we understand philosophy in its more general sense as logical and rational discourse upon the nature of things, then al-Bīrūnī must certainly be considered as a philosopher of note to be studied for his significance in the general context of Islamic intellectual history and also for the innate value of his intellectual vision Of course he is still a traditional philosopher, even if not a member of the well established schools, for profane and secular philosophy simply did not exist in Islamic civilization and certainly would not have concerned such a profoundly religious man as al-Bīrūnī, even had it existed

Al-Bīrūnī was a scientist, scholar, compiler and philosopher for whom the quest for knowledge was held as the supreme goal of human life He respected knowledge in all its forms and hence sought it wherever and in whichever form possible He saw in knowledge an almost divine quality very much in conformity with the fundamental tenets of Islam, whose spirituality is "gnostic" in nature, and with the values exalted by Islamic civilization[2] Hence al-Bīrūnī, with the universal vision and the remarkable intellectual qualities which he possessed, turned to Greek as well as Persian and Indian sciences, to both the religious Islamic sciences and the intellectual ones He holds the rather unusual distinction of being at once one of the greatest mathematicians and historians of humanity And he wrote in nearly every field, from astronomy to pharmacology[3] But strangely enough, unlike his contemporary scientist Ibn al-Haitham, al-Bīrūnī has not left behind independent philosophical works of a systematic nature The only exception among his extant works is the *Questions and Answers* (*al-As'ilah wal-ajwaibah*) exchanged with Ibn Sīnā, which deal with

cosmological, physical and philosophical problems.[4] As for his lost works, he apparently wrote three philosophical narratives, *'Ayn al-ḥayāt*, *Qāsim al-Surūr* and *Urmuzdyār wa mihryār*, which if found would be very significant, considering the importance of this kind of philosophical narrative romance in the corpus of Ibn Sīnā, Suhrawardī and many other Islamic philosophers [5]

In order to understand al-Bīrūnī's philosophical thought, it is therefore necessary to turn to his other writings dealing with history, geography or even astronomy, for in nearly all of these works, one will find elements dealing with philosophy, cosmology and metaphysics interspersed within the main scientific or historical discussion at hand In the *India* not only does al-Bīrūnī describe Indian doctrines, but he often comments upon them and offers his own metaphysical and philosophical ideas and interpretations In his *Chronology of Ancient Nations* profound observations are made about the nature of time and the cycles of human history as well as the origin of the order observed in nature In *The Determination of the Co-ordinates of Cities* the origin of science and its classification are discussed as are themes related to the question of the origin and creation of the Universe One could go on in the same vein with his other writings [6] Moreover, the very fact that he chose to translate into Arabic such a work as the *Patanjali Yoga* shows his intense interest in metaphysical and spiritual matters.

When all of these sources are extracted and studied it becomes clear that al-Bīrūnī was neither a peripatetic, nor a follower of scholastic theology (*kalām*), nor a disciple of Hermetic philosophy or the Isma'ilī philosophy related to it, nor a member of any of the other established schools of his time The most noteworthy aspect of his philosophical views is his strong and often original criticism of Aristotelian philosophy, which is reflected in the questions and answers he exchanged with Ibn Sina and his student 'Abd Allah al-Ma'ṣūmī [7] Al-Bīrūnī thus belongs to a series of independent anti-Peripatetic thinkers of the early period of Islamic history who were also scientists, such men as Muḥammad Ibn Zakarīyā' al-Rāzī, whom in fact al-Bīrūnī both admired and criticized [8]

Al-Bīrūnī did not oppose all the teachings of Peripatetic philosophy *en bloc* Rather, basing himself on firm religious faith in Islam on the one hand and the tool of logic, rational analysis and observation on the other he refuted many of the theses of Peripatetic philosophy, such as the eternity of the world and the possibility of indefinite division of matter What is important for an understanding of Islamic intellectual history is that such a strong and rigorous criticism of Peripatetic thought did not come from a nominalist or rationalist, as was to happen from the end of the Middle Ages to the 17th century in the West, but that it came from a man like al-Bīrūnī who was deeply immersed in both the life of faith and metaphysical and cosmological doctrines of Islam and other traditions It is of great significance for an understanding of the reason for the different paths that Islamic and Christian civilizations were to take at

the end of the Middle Ages that one of the foremost critics of the Aristotelian world view in Islam should also be the person who introduced the *Patanjali Yoga* to the Islamic world and one of the few Muslim figures really well versed in the Vedanta

In order to understand al-Bīrūnī's philosophical views it is necessary to turn to a few specific subjects In the question of cosmogony and creation, al-Bīrūnī rejected violently the idea of the "eternity" (*qidam*) of the world and like the Islamic theologians held that to believe in the eternity of the world is to negate the need for a cause for the world and therefore to negate indirectly Divine Unity ((*al-tawḥīd*), which was the principle most dear to al-Bīrūnī[9] In fact the whole of al-Bīrūnī's works can be interpreted as a quest for the realization of unity in various forms of knowledge and planes of existence It was most of all with the aim of preserving the inviolability of the doctrine of unity that he criticized the Peripatetic view of the eternity of the world in the second of the questions he posed to Ibn Sīnā, and refused to accept the Peripatetic response that an existent needs a cause not because it has a temporal origin, but basically because it is a possible being (*mumkin al-wujūd*) and is therefore in need of the Necessary Being (*wājib al-wujūd*) in order to become actualized and to gain existence The debate between al-Bīrūnī and Ibn Sīnā as well as al-Ma'ṣūmī on this subject concerns one of the most important questions of Islamic philosophy, namely the condition under which something needs a cause Al-Bīrūnī identified the eternity of the world with its not being created For him, in contrast to Ibn Sīnā, the "newness" of the universe (the quality of being *hadith*) implied its being created (*makhlūq*), and the denial of this "newness" or acceptance that the world does not have an origin in time destroyed the conception of the creation and ultimately the unity of the Creator and his power Hence in other works such as *The Determination of the Co-ordinates of Cities* he affirmed clearly his belief in the created nature of the world[10] and tried to provide both scientific and theological reasons for it

As a result of his vast and varied study of nature, history and various traditional doctrines of time and of the world, al-Bīrūnī became clearly aware of the qualitative nature of time, of the fact that it is not uniformly stretched out like a mathematical coordinate He also strongly denied the idea of uniformitarianism so dear to modern geology and palaeontology and provided both scientific and philosophical arguments to disprove it[11] For al-Bīrūnī time has a cyclic nature, but not in the sense of returning to the same point again, which is a metaphysical absurdity and a modern caricature of the real traditional teaching[12] Rather, by "cyclic" al-Bīrūnī understands qualitative changes and correspondences between various elements of time within each cycle Without doubt his profound study and intimate knowledge of not only the Qur'ānic conception of time, which is based on cycles of prophecy, but also the teachings of the *Puranas* and of many other traditions on the meaning of time and history helped al-Bīrūnī develop perhaps more profoundly than any other Islamic

philosopher and scientist the meaning of qualified and cyclic time and its implications for the study of nature and of man

A basic aspect of al-Bīrūnī's thought, which is closely related to his treatment of time, concerns the development and becoming of things, which many have by mistake identified with the modern theory of evolution, the latter being no more than a parody of the traditional doctrine of gradation [13] Al-Bīrūnī was fully aware of the long history of the earth, of the cataclysms which changed mountains into seas and oceans into continents, of the fact that certain species preceded others on earth and that each species has its own life cycle [14] Pondering over the vast panorama of nature in both time and space and the teachngs of various sacred writings on the creation and subsequent history of the universe, al-Bīrūnī became aware of the basic principle that the development and becoming of things in this world is the gradual unfolding and actualization of all the possibi' ties that are inherent within each being Nothing evolves from one form into another as a result of external additions or accretions, rather whatever transformation does take place is no more than the manifestations of possibilities already present in that being In the same way, what becomes manifested at a particular period of history is no more than the unfolding of possibilities inherent in that particular cycle of time This principle, which is one of the cornerstones of al-Bīrūnī's thought and is a crystallization of well-known traditional doctrines, is applied by al-Bīrūnī to his study of various domains of nature, both animate and inanimate, as well as to history and man

Being an outstanding physicist, al-Bīrūnī was deeply interested in the general principles of natural philosophy, in such questions as motion, time and matter, as is again seen in his criticism of Aristotelian natural philosophy presented in the series of questions and answers exchanged with Ibn Sīnā As far as the nature of matter is concerned, he sided with the Islamic theologians against the Peripatetic view of hylomorphism and supported the atomism of *Kalām*, which was originally formulated by Abū Hudhayl al-'Allāf and other earlier Mu'tazilites The arguments offered by al-Bīrūnī against hylomorphism and in support of atomism are mostly those of the theologians with certain scientific arguments elaborated and expanded to support the usual logical philosophical arguments It is somewhat strange that a scientist such as al-Bīrūnī should support the view of the theologians concerning the structure of matter, for usually the Muslim scientists believed in the continuity of matter, and even Rāzī, who believed in atoms, posited a form of atomism akin to that of Democritos and not like the atom (*juz' lā yatajazzā'*) of the theologians (*mutakallimūn*) [15]

Of paramount importance for an understanding of al-Bīrūnī's philosophical ideas is his view of knowledge and the methods used for its attainment Al-Bīrūnī held a view of knowledge which was at once dynamic and static, that is he believed clearly in the gradual development of particular forms of knowledge and at the same time in the immutability of principal knowledge derived from

revelation In his treatment of the sciences he usually dealt with their history and gradual development as is seen so clearly in his *Maqālīd'ilm al-hay'ah* (*Keys to the Science of Astronomy*), in which the history of the subject preceding al-Bīrūnī is treated carefully In fact in addition to being the founder of the discipline of comparative religion or the history of religion he must also be considered as one of the founders of the history of science Yet, he never lost sight of immutable knowledge, which for him is always found in the revealed scriptures and which provides the matrix for all the human sciences which change and develop

Moreover, al-Bīrūnī was the great champion of pure knowledge and its value for the perfection of man Of course in Islam there has never been the idea of "science for science's sake" as is found in the West But within the context of Islamic civilization al-Bīrūnī[16] emphasized the importance of pure knowledge and the pursuit of knowledge for the sake of the perfection of man as against those who stressed the importance of its utility Of course inasmuch as al-Bīrūnī spoke within the context of the traditional world view his defense of pure knowledge and the view of those who emphasized its utility met at the highest level, for what can be more "useful" to man than the knowledge which is an adornment for his soul and the means for its attainment of perfection Al-Bīrūnī himself was aware of those two poles and attitudes involved and in his own writings combined the aspect of pleasure (*lidhdhah*) associated with the attainment of knowledge with its aspect of utility (*manfa'ah*) For him the two were not completely divorced from each other but were complementary in the deepest sense

As far as methodology is concerned, the most significant feature of al-Bīrūnī is that he never became the slave of a particular method nor accepted that kind of tyranny of methodology characteristic of so much of modern science He used different methods in different sciences in conformity with the nature of the science in question Where it was necessary he used induction, or observation, or experimentation, or deduction or had recourse to intellectual intuition He was the most exact of scientists without ever being fooled into believing that the methods of experimental science could be applied to the domain of religion or the sciences of man That is why in al-Bīrūnī, who in a sense summarizes the whole history of Islamic science, there is no single method but *methods* for acquiring various forms of knowledge in conformity with the innate nature of the sciences in question.

The basic significance of al-Bīrūnī for the modern world and especially the contemporary Islamic world in fact is not only in that he was the father of geodesy or that he weighed several precious stones and metals carefully or even that he criticized Aristotelian natural philosophy profoundly Rather, it is most of all in his success in being an outstanding scientist but not only a scientist, in being scientific without being scientistic It is in being logical without losing

sight of the spiritual empyrean, the knowledge of which is not irrational nor illogical but unattainable through logic and reason alone It is his remarkable sense of discernment which was able to give each form of knowledge its due, to assign to each element the place to which it belonged by nature, so that he could practise mathematics with the rigour of the greatest of mathematicians and at the same time write of human affairs with a vision that is much more profound than the view of those in the modern world who try to ape the methods of the exact sciences in the field of the humanities and who do not possess a fraction of al-Biruni's scientific knowledge

Al-Bīrūnī stands as the model of the thinker who was able to harmonize within his own intellectual vision various forms of knowledge, from the sciences of nature to religion and philosophy He also stands as proof that it is possible within a traditional world-view to develop and even found various branches of the sciences without becoming enslaved by them and without falling under the deadly influence of belief in the unilateral and tyrannising power of science so prevalent today, a belief whose end cannot but be the stifling of the human spirit and the destruction of the natural environment which itself serves as support for man's terrestrial journey

NOTES

(1) See S H Nasr, "The Meaning and Role of Philosophy in Islam", *Studia Islamica*, vol XXXVII, 1973, pp 57-80

(2) On the gnostic nature of Islamic spirituality see F Schuon, *Understanding Islam*, trans by D M Matheson, London, 1963, Baltimore (Penguin Books), 1972, especially chapters one and four Also S H Nasr, *Ideals and Realities of Islam*, London, 1967, Boston, 1972, Chapter I

(3) On al-Bīrūnī's writings see D J Boilot, "L'oeuvre d' al-Bīrūnī essai bibliographique", *Melanges Ins Dominican du Caire*, 1955, vol 2, pp 161-256, also S H Nasr, al-*Bīrūnī · An Annotated Bibliography*, Tehran 1352 (A H Solar)/1973.

(4) See al-Bīrūnī, *al-As'ilah wa'l-ajwaibah*, ed by S H Nasr and M Mohaghegh, Tehran, 1352 (A H Solar)/1973.

(5) On the significance of the "visionary recital" in Islamic philosophy see H Corbin, *En Islam Iranien*, vol II, Paris, 1971, pp 211 ff

(6) See S H Nasr, *An Introduction to Islamic Cosmological Doctrines*, Cambridge (U S A), 1964, chapters 6-10.

(7) For an analysis of these questions and answers see the introduction of S H. Nasr to his edition of the *As'ilah wa'l-ajwaibah*, S H Barani, "*Ibn Sīnā and Alberūnī, a study in similarities and contrasts*", *Avicenna Commemoration Volume*, Calcutta, 1956, pp 3-14, M Mutahhari,

"Pursish-ha-yi Falsafi-yi Abū Rayḥān az Bū 'Alī, "*Essays on al-Bīrūnī*, Tehran, 1352 (A H Solar) 1973, pp 54-163, and Y N Zavadovsky, "Ibn Sīnā i ego filosofskays polemike a Bīrūnī", *TIVAN Uz SSR*, vol 1, 1953, pp 46-56

(8) See S Pines, "Quelques tendances anti-peripaticiennes de la pensee scientifique islamique", *Thales*, vol 4, 1940, pp 210-19

(9) This point is analyzed extensively in Muṭahharī, *op cit*, pp 86 ff

(10) See al-Bīrūnī, *The Determination of the Coordinates of Cities*, trans by J Ali, Beirut, 1967, pp 14-15

(11) See Nasr, *An Introduction* , pp 118-119

(12) For an authentic exposition of the traditional doctrine of cycles see R Gu'enon, *Formes traditionnelles et cycles cosmiques*, Paris, 1970

(13) See S H Nasr, *The Encounter of Man and Nature, the Spiritual Crisis of Modern Man*, London, 1968, pp 124 ff

(14) Nasr, *An Introduction* chapter 6

(15) On atomism among Muslims see S Pines, *Beiträge zur islamischen Atomenlehre*, Berlin, 1936

(16) For the role played by knowledge in all its aspects in Islamic civilization see F Rosenthal, *Knowledge Triumphant*, Leiden, 1971

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AL-BĪRŪNĪ'S OUTLOOK OF MAN AND SOCIETY

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AL-BĪRŪNĪ has shown great interest in history which deals with the development of societies in the course of time, and his interest in geography and also in ethnology, for which he uses the term *ma'rifah al-umam*, may be tied up to his concern as disciplines ascertaining the effects of physical and social environments on human life Even though he has not devoted special monographs to these studies of his, he goes into these topics at times in the introductory sections of his book, or in the prefatory dedications of some of his works to certain kings, or, again, taking advantage of other occasions which presented themselves in various contexts

According to al-Bīrūnī, man who is superior to all other creatures, has the capacity of attaining to a knowledge of the existence and essence of God, and as a consequence of this superiority, man is the supreme creature to whom all other creatures should be subservient In this connection al-Bīrūnī ties up human psychology with physiology and medicine through the classical theories of the four humours and constitutions

Moreoever, al-Bīrūnī approaches the birth of societies in a deterministic and materialistic spirit In his opinion, man is, by nature inclined to being critical and not easily manageable He is on the other hand forced by the circumstances to set up an economic and social way of life and to rule and exploit his physical environment In other words, the continuance of man's life depends on his setting up a civilization and submitting himself to a set of rules and regulations

Man has had to develop the arts and crafts, to form communities, and work together on the basis of specialization Each man thus exchanged the product of his labour with that of people of other professions This need resulted in accepting silver and gold, which were rare and of non-deteriorating quality, as standards of exchange Hence the introduction of using coins But this type of exchange had to be guarded against abuse, and the currencies adopted had to be backed up and controlled by official authorities Counterfeit money and economic dislocations which it caused had to be avoided, and this stressed the need for a strong ruler and established authority

As human welfare thus became dependent on gold and silver, greed for their possession became more and more pronounced In reality, however, the exchange of products is the essential factor which governs the economic interrelations of man The conventional value attached to money, resulted in the creation of rich and powerful strata within societies

God has forbidden the hoarding of gold and silver and has disapproved the uses of drinking cups made of gold and silver He has frowned upon those who thus withdraw money from circulation and has threatened them with severe punishment in the other world To hoard money and to bury up gold and silver in the ground, is in fact like reintroducing a born babe into its mother's womb Once gold and silver have been extracted from the mines, they resemble harvested corn and slaughtered animals The only thing to do with them is to consume them Gold and silver too should be made instrumental in order to secure justice and equity in trade and business relations Consequently we see that al-Bīrūnī considers economic relationships as the foundations upon which human society rests and was originally built Again, in his opinion the main function and responsibility of the heads of governments are to preserve economic order and to establish a smooth relationship between different classes in societies

Thus, al-Bīrūnī is, on the one hand, a materialist in his theory concerning the social and economic aspects of society, while, on the other hand, he is an idealistic moralist, because he considers moral and religious rules and precepts indispensable in order to restrain and prevent human greed and inclinations for fraudulent activities and profiteering misdeeds Man could achieve happiness through controlling his natural proclivities for unlawful acts, and attain to a state of material and moral purity This entails sacrifice of personal interests and devotion to the good of the society as a whole According to al-Bīrūnī wisdom consists of deriving pleasure from contributions of lasting value Real happiness is everlasting, whereas material and bodily pleasure is of short duration and accompanied by pain

In al-Bīrūnī's view there are certain factors which disrupt human peace and comfort These are

(1) Although human beings are the highest in rank among creatures, the divergences in their nature and feelings sometimes cause rivalry between them and lead them to look askance to the possessions of others and move them to seize by force things that belong to others

(2) Another reason for discord among people is that each considered their own nation superior to others and show apt fanaticism in this respect

(3) Superstitions also sow seeds of misunderstanding and discord among people.

The most effective element in securing the stability and welfare of societies is the authority of the state and the ruler who represents this authority, according to al-Bīrūnī He says in his *Kitāb al-Jamāhir* that fear of God and obedience towards kings restrain people from irresponsible deeds If the king is not powerful and lacks needed authority, he will not be able to rule his subjects and every one will claim equality with him Kingship originated from superior physical strength of certain individuals who thus became chiefs of tribes This motion of superiority underwent certain changes until it began to be conceived as a power handed down to the ruler by God He gives several examples of this sanctification of political power

According to al-Bīrūnī, rulers have to hoard and amass wealth and possession For they can continue to govern only with the help of money Not all people are philosophers Most of them are ignorant, and there is no way of leading them into proper conduct except by force and coercion For the same reason, rulers have to depend on an aristocracy of well-to-do people In chapter 9 of his *India*, al-Bīrūnī openly expounds his concept of an ideal society The ruler should be truly in possession of strong character, non-vacillating in the decisions he makes, and his capacity and natural disposition should be such that he should easily find his way out of difficult and critical situations Moreover, as a consequence of support of his people, if such a ruler, has the desired support from religion, then these two powers will be in a state of perfect accord

Al-Bīrūnī views it as necessary that there should be several classes in society in order to govern it properly On this occasion he refers to the principle of equality in Islam and says that India is an exemplification of the principle of the multiplicity of classes and adds that this difference has constituted the major barrier in achieving an accord between Islam and India In the same passage he openly praises old rulers who had divided their people into different classes and achieved harmony in their mutual relations by seeing to it that each remain within its bounds and pursue its own duties and professions Among them he makes special mention of old Persian kings and in particular Ardashir, the son of Babak

Al-Bīrūnī looked upon religious and denominational differences with an indulgent eye, provided these should not cause harmful effects on the smooth and peaceful conduct of affairs He was also sympathetic to the Indians and he showed understanding for their shunning close relations with Islam in view of the historical circumstances that had prevailed in their mutual contacts, He considered it therefore a necessity to study India and its people with an objective and critical approach He considered humanity as an essentially indivisible whole, and his love of truth and the great value he attached to man became united in his invaluable and many aided scientific researches

AL-BĪRŪNĪ AND HUMAN VALUES OF THE EASTERN RENAISSANCE

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IN this paper an attempt is made to point out the importance of the human experiments and observations on which al-Bīrūnī based his theories and views It is these experiments and observations which distinguish man from beasts and enable him to change his environment and history Since experiments and discoveries are products of human effort and creativity we call them 'human values'

Al-Bīrūnī is insistent on the necessity for human experiment, and lays stress on the importance of one's own scientific and practical findings as opposed to blind imitation of others For many centuries knowledge of the natural world was based on mere assumptions given credence by long practice or the imitation and slavish following of the views expressed by Plato, Aristotle and others The independence of al-Bīrūnī and other thinkers such as Rāzī, Fārābī and Ibn Sīnā in medicine, chemistry, philosophy, astronomy, social anthropology, religion etc, opened a new horizon in the field of knowledge, which we call the Islamic or Eastern Renaissance (900-1200) It was the same creative spirit of experiment which started the Western Renaissance The question why the West could apply this science in her social and industrial development, whereas the other countries in the East failed to do so, has political, sociological and economic implications which fall outside the compass of my paper However, we must bear in mind that the influence of great Eastern thinkers is well rooted in the writings of later generations Dehkhodā of Iran and Iqbāl of Pakistan, for example, are the product of past and present

Al-Bīrūnī's insistence on the necessity for human experiment, and on particular rather than general knowledge, gives him great critical power and vision His opposition to and criticism of Aristotle and his followers or sympathisers, such as Ibn Sīnā, are a revolt against a system of thought rather than individuals. This revolt of al-Bīrūnī stems from his conviction that truth can be achieved only by experience and embracing reality, not by passive obedience or escaping from the world which surrounds us The correspondence between al-Bīrūnī and Ibn Sīnā, for example, illustrates the difference between acquired knowledge or knowledge based on experience, and the knowledge of 'it is said' One of the

questions with which al-Bīrūnī challenges Ibn Sīnā is this—'If the existence of a vacuum is impossible, why does a bottle, whose air is sucked out, suck water up into the bottle?' Al-Bīrūnī had himself arrived at this and many other conclusions after several experiments In other words, his conviction was the result of an objective and practical knowledge

Objective and practical experience, however, is not enough It must be based on human principles and work for the betterment of human life Otherwise, science becomes harmful and the enemy of man Al-Bīrūnī was conscious of this In his introduction to *Āthār al-Bāqiyah* he writes—'In order to find one's way to truth and to be an honest scholar or investigator, one must free oneself from harmful elements such as prejudice, aggression and desire to rule, and indulgence to selfishness, all of which have been the cause of death among people and have also prevented truth from being recognised Cleansing oneself from these harmful elements is the best policy to our aim of truth, and is the powerful companion which can destroy doubt and hesitation within us Although this way is the more difficult one and requires sacrifices, yet it is worthwhile, for there is no other way than this which could lead us to our aim' [1]

The Eastern or Islamic Renaissance is based on this policy and outlook It revolts against static, scholastic and dogmatic outlook in religion, philosophy, science and history Al-Bīrūnī's assertion of human experiment is in deed in direct opposition to those who separate religion, philosophy and history from the human being and his living circumstances To divorce religion, philosophy and history from man and his world of experience is, according to al-Bīrūnī, non-scientific and mere abstraction Thus the treatment of knowledge without the context of man is a reduction of it into a mere mental activity which has no existence except in the mind of the passive thinker or meditator Al-Bīrūnī's approach to astronomy, religion, science and history closes the gulf which existed between subject and object, religion and myth, science and experiment He criticises theologians who interpret the Qur'an and mythology literally, and thus divorce or abstract them from their material context and reality and divide the body from the spirit or word from the meaning In other words, al-Bīrūnī opposes the abstraction of the mental deities from their objects This division of subject from object, spirit from body, word from thing and prophet from history, is erroneous and contrary to the spirit of Islam and the Qur'an When, for example, we read in the Qur'ān اتى امر الله فلا تستعجلوه ('When the order of Allah comes, hurry'), al-Bīrūnī argues that we have to appreciate the difference between metaphor and meaning [2] Continuing his argument in this matter, al-Bīrūnī concludes the introductory chapter of *Āthār al-Bāqiyah* "The purpose of what I have said here is only this If someone thinks necessities

1 *Āthr al Baqiyah* Abu Raihān Bīrūnī translated by A Danacerisht Tehran, 1973, pp 3-4

2 *Ibid*, p 14

and realities (self-evident truths) are contrary to the Qur'ān and backs up his erroneous assumption by referring to sayings of one of the theologians or commentators, then I repudiate this assumption "[1]

The Qur'ān is read by two different people differently because their intentions and outlook are different Al-Bīrūnī opposes theologians because they separate man, society and the necessities of life from the Qur'ān and its living symbols and stories Thus religion, which is supposed to serve human development and progression, becomes instead a negatoı of man and his social and economic development

Discussing the origin of history and the names of Iranian months and festivals, al-Bīrūnī leads his readers among people and illustrates their living conditions, professions and joys The names of months, for example, are not abstract names but are mainly inspired by the active life of people and their celebration of good crops and plenitude or freedom of their land and country from external aggression Farvardin month, or Noroorz (Nawroz), is the 'month of hope' and revolution when plants renew their life and rain washes away the dirt and dust which remain from winter The sun shines and clears the earth of germs Noroorz (Nawroz) in a time when people are freed from the shortage of water and food and there is plenty to eat, for all[2] The Ordībehısht or Ordībehist feast is meant to be the month of blessing and betterment of life Khordād is meant to be the month of emancipation, both for people and for nature It was also in this month that the story of Arash had unfolded Other months and festivals are presented, full of life and human activity

Thus al-Bīrūnī manifests the spirit of the Eastern Renaissance by the emphasis which he places upon human values and dignity as being of more worth than theological and scholastic arguments It is this same creative spirit that we notice in later great Islamic thinkers such as Iqbāl Attacking the existing social and theological system and defending the wretched people against the ruling interests, for examole, Iqbāl writes in *Armaghān Hijaz* (pp 164-5)—

مگو با من خدای ما چنین کرد
که شستن میتوان از دامن گرد
ته و بالا کن این عالم که در وے
قمارے می برد نامرد از مرد
برون کن کینه را از سینه خویش
که دود خانه از روزن برون به
زکشت دل مده کس را خراجے
مشو اے ده خدا غارت گرده

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1 *Āthār al-Bāqiyah*, Abu Rāihān Bīrūnī, translated by A Danaceısht, Tehran, 1973, p 15

2 *Ibid*, pp 279-86

'Do not tell me that God has done this,
You can wash away the dust by this excuse
Turn this world upside down
Where the unjust steals from the just,
Bring hatred out of your heart,
For smoke should go out of the house;
In the world of the heart do not bring destruction
Do not be the head of village who plunders the village'

It is al-Bīrūnī's love of man and his respect for the genius and creative qualities of man which make him an international figure It is this conviction which can break the limited borders of prejudice and rigidity and open the way for human progression

To conclude The lessons to be learned from al-Bīrūnī are still relevant His insistence on the necessity for human experiment, and his emphasis on the importance of scientific and practical findings, are the principles upon which modern sociological and technological developments are based Though our ancestors in the East could not utilise these principles in their social and human development ten centuries ago, we, as a young generation, should regain what is lost in the past by giving the utmost importance to these 'human values' which al-Bīrūnī and other pathfinders put in front of us

AL-BĪRŪNĪ AND THE STUDY OF NON-ISLAMIC RELIGIONS

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IN the *Al-Bīrūnī Commemoration Volume* published by the Iran Society of Calcutta in 1951 there is an article of nearly forty pages (pp 125-160) by the late Arthur Jeffery of New York entitled 'Al-Bīrūnī's Contribution to Comparative Religion' Jeffery concludes by suggesting that 'in this field of the sciences of the spirit' al-Bīrūnī's contribution to learning was possibly greater than 'in the field of the more exact sciences' 'It is rare until modern times', he says, 'to find so fair and unprejudiced a statement of the views of other religions, so earnest an attempt to study them in the best sources, and such care to find a method which for this branch of study would be both rigorous and just' (160) In the course of the article he first describes al-Bīrūnī's method, of which the sentence just quoted summarizes the main features, and then gives some account of his treatment of special topics, like idols and demons, and of his views on Hinduism, Buddhism and other religions In the present lecture it would be pointless to repeat what has already been very competently done by Jeffery I am in general agreement with what Jeffery has said, and my remarks here must therefore be understood as complementary to his study insofar as they extend the discussion to further aspects of the general subject

In the period of about a quarter of a century since the writing of the article the very concept of 'Comparative Religion' has been falling into disfavour This does not mean that the discipline so described is ceasing to be practised, on the contrary it is rather increasing As it develops, however, it is being subtly transformed by a number of factors beyond the control of its practitioners, and in consequence most of these practitioners feel that the designation 'comparative religion' is no longer suitable, since 'comparing religions' is now a small part of what they are doing The old name lingers on, however, in some quarters, because there is no agreement on a replacement The commonest alternatives, 'history of religions' and 'religious studies', are too wide

It must not be supposed that this is a mere hair-splitting argument about names, of the type so dear to the academic mind The discipline itself has been radically changed, especially by two factors firstly, the greatly increased amount

of printed material available, and secondly, the still greater increase in contacts between adherents of different religions, meeting one another as social equals The term 'comparative religion' conjures up the picture of a late-nineteenth-century scholar sitting in his study with shelves of books and learning from these practically all that was to be known about half a dozen or more religions This is no longer possible, for the amount of material is such that virtually no scholar is able to become an expert on more than one religion besides that which he practises It is of course still desirable to have scholars who can discourse acceptably about half a dozen religions, but those who do so would be the first to admit that their knowledge of each of these religions is relatively slight

The late-nineteenth-century scholar was also in the position of hardly ever meeting adherents of the religions about which he wrote or visiting the countries where they were practised He could scarcely avoid being inaccurate here and there, but it was unlikely that anyone professing the particular faith would read what he had written and correct it Now all this has changed Ease of travel has made contacts possible between the religions at many different levels, from the Asian student who goes to Europe or America to work for a doctorate to the European or American 'hippie' who comes to Asia seeking spiritual enlightenment A scholar who writes on Islam in English must expect to have his books read and his statements checked by dozens of well-educated Muslims One of the popular ways of describing this situation is to say that we live in an age of 'dialogue'

The first thing to be noted about al-Bīrūnī's study of religions is that, while on the one hand he made comparisons between them, he was also living in a world in which 'dialogue' was taking place In the introduction to his *India* (7/4) he says that his master Abū-Sahl al-Tiflīsī incited me to write down what I know about the Hindus as a help to those who want to discuss religious questions with them, and as a repertory of information to those who want to associate with them At the conclusion of the whole book he refers again to the possibility of 'dialogue' 'We think now that what we have related in this book will be sufficient for anyone who wants to converse with the Hindus, and to discuss with them questions of religion, science or literature, on the very basis of their own civilisation' He was also alive to the fact that statements about a religion would be open to the criticism of its adherents, and insisted that a scholar must be 'alive to the requirements of a strictly scientific method' and must not be content with 'some superficial information which will satisfy neither the adherents of the doctrine in question nor those who really know it' (6/4) In these respects, then, it may be claimed that al-Bīrūnī had gone beyond the Comparative Religion of the late nineteenth century

Another contemporary trend in this discipline, especially among those concerned with religious education, is the attempt to discern a unity in the total religious experience of mankind and to present this to others Something

of this trend is also to be found in al-Bīrūnī Although he is admirably objective and unprejudiced in his presentation of facts, this does not mean that he has no views of his own On the contrary he selects facts in such a way that he makes a strong case for holding that there is a certain unity in the religious experience of the peoples he considers, even though he does not appear to formulate this view explicitly His view is implicit, however, in such statements as that 'all peoples understand by the punishment of Hell the most dreadful things which are known to them' (67/33)

At the centre of al-Bīrūnī's view of the unity of religions is a distinction between the beliefs of the ordinary men and those of the intellectual minority Thus he says 'The belief of educated and uneducated people differs in every nation, for the former strive to conceive abstract ideas and to define general principles, whilst the latter do not pass beyond the apprehension of the senses, and are content with derived rules, without caring for details especially in questions of religion and law, regarding which opinions and interests are divided' (27/13) In respect of the application of family relationships to divine beings he says the educated among the Hindus abhor anthropomorphisms of this kind, but the crown and the members of the single sects use them most extensively' (39/19) On the basis of this distinction al-Bīrūnī identifies Hinduism with the beliefs of the educated, and is therefore able to describe it as a pure monotheism 'The Hindus believe with regard to God that he is one, eternal, without beginning and end, acting by free-will, almighty, all-wise, living, giving life, ruling, preserving, one who in his sovereignty is unique, beyond all likeness and unlikeness, and that he does not resemble anything nor does anything resemble him' (27/13) He justifies this assertion by quotations from Hindu texts

In the chapter on the sources of religious and civil law he notes that the Greeks and Hindus received their laws from sages or kings, and he further notes that the Greeks, including Plato in the *Laws*, thought that the law-givers were divinely inspired Al-Bīrūnī does not speak of divine inspiration in the case of the Hindus, but tells a somewhat scandalous story to prove that their laws have in fact been changed and are not, as their scholars contend, immutable He concludes the chapter by emphasizing that the institutions of Islam are vastly superior to the foul customs and usages he has just described

His treatment of idols is interesting As one would expect, he regards the worship of idols as exclusively a characteristic of the common people, with which the educated have nothing to do He holds that the practice is due to a kind of confusion or corruption In this he follows a Greek theory—he quotes the case of Galen and Asclepius (35/16f)—and applies it universally, asserting that the physical images are 'monuments in honour of certain much venerated persons, prophets, sages, angels, destined to keep alive their memory when they are absent or dead, to create for them a lasting place of grateful veneration in

the hearts of men when they die' (111/53) He then goes on to maintain that in the course of generations the origin of the veneration of the images is forgotten, and further that the ancient legislators, seeing that the veneration of images is advantageous, made it obligatory for the ordinary people He mentions the view of some people that, before God sent prophets, all mankind were idol-worshippers, but he apparently does not accept this view He presumably held that, apart from the messages transmitted by prophets, men could know the existence and unity of God by the rational methods of philosophy

So far as the ordinary people go, then, there are differences from religion to religion between the idols, forms of worship and moral rules What makes it possible for al-Bīrūnī to regard the religious experience of mankind as essentially one is his insistence on the cleavage in respect of religion between the masses and the educated minority, whom he tends to identify with the philosophers He expresses himself as follows

> The heathen Greeks, before the rise of Christianity, held much the same opinions as the Hindus, their educated classes thought much the same as those of the Hindus, their common people held the same idolatrous views as those of the Hindus (24/12)

After a remark to the effect that he is not trying to correct these views, since heathenism, as a deviation from the truth, cannot be corrected, he continues

> The Greeks, however, had philosophers who, living in their country, discovered and worked out for them the elements of science, not of popular superstition, for it is the object of the upper classes to be guided by the results of science, whilst the common crowd will always be inclined to plunge into wrong-headed wrangling, as long as they are not kept down by fear of punishment (He gives Socrates and the crowd as an example of his point) The Hindus had no men of this stamp both capable and willing to bring sciences to a classical perfection Therefore you mostly find that even the so-called scientific theorems of the Hindus are in a state of utter confusion (24-5/12)

This last remark is probably intended to apply to the sciences of the Hindus in a limited sense and not to their philosophy, for in other places it is made clear that there are educated Hindus who engage in philosophical studies and who, like the Greek philosophers, believe in one God

> For those (sc among the Hindus) who march on the path to liberation, or those who study philosophy and theology, and who desire abstract truth which they call *sara*, are entirely free from worshipping anything but God alone, and would never dream of worshipping an image manufactured to represent him (113/54)

His statement of what he regards as the central Hindu belief in monotheism has already been quoted In short, the Hindus, no less than the Greeks, have philosophers who are believers in monotheism

In the course of these remarks it will have become clear that al-Bīrūnī, in his conception of the religious experience of mankind, was greatly influenced by Greek philosophy This is not at all surprising In other papers of this conference we have heard of his great achievements in science, and this means that he must have read all the Greek scientific books available in Arabic before proceeding to make his own contributions Greek philosophy was grouped together with the sciences in such a way that anyone who studied the sciences was bound to study philosophy According to Edward Sachau in the preface to his translation of al-Bīrūnī's *India* (p xii), over a dozen Greek authors are mentioned in it, and for some of them several books are named Thus he was both well-versed in Greek thought and also sympathetic to the Greek standpoint It is in line with this that he should for a time have been in correspondence with Ibn Sīnā On the other hand, there is nothing to show that he fully accepted the Neo-Platonism of men like al-Fārābī and Ibn Sīnā, it is unlikely that he could have been deeply influenced by the latter, who was seven years his junior, but he had doubtless heard of al-Fārābī It is possible, however, that his sympathies for Greek philosophy were balanced by some degree of sympathy for Ismā'īlism In the biography in the *Irshād* of Yāqūt (vi 310f) it is stated that he was suspected of Qarmaṭian views, and in his own *India* (64/32) he quotes an Ismā'īlite writer, Abū-Ya'qūb al-Sijzī (*GALS* i 323, *GAS*, i 574), on the subject of metempsychosis Ismā'īlism, in addition to its interest in Greek philosophy, was characterized by a positive attitude towards other religions, though it also claimed to supersede them

Another small point to notice in this connection is that al-Bīrūnī regards the Ṣūfīs, to whom he refers several times in his India, as a type of philosopher He introduces them (33/16) as persons holding a form of philosophical monotheism, and insists that their name—which he here spells with *sīn* instead of *ṣād*—is derived from the Greek word *ṣūf* meaning 'wisdom' (ḥikmā), adding that the Arabic *faylāṣūf* is in Greek *paylāsūpā* or 'lover of wisdom' He is aware of the suggested derivations from ṣuffā, *ṣūf* and *ṣafā*, but holds emphatically that these are all erroneous, though he is apparently less critical of the derivation from *ṣafā*, 'purity', than of the others

In view, then, of al-Bīrūnī's sympathy with Greek philosophical and possibly Ismā'īlite attitudes, what is to be said about his loyalty to Islam? It is known that he had an important position under Sulṭān Maḥmūd of Ghaznāh, and that the latter was a strong supporter of Sunnite Islam against the Imāmism of several autonomous princes of the time The presumption is thus that he was a Sunnite, or at least that he was careful to say nothing that would offend the susceptibilities of Sunnites The general impression given by his writing is that he sat lightly to the niceties of Sunnism, but from time to time he introduces remarks whose chief

purpose seems to be to silence critics, examples of this already quoted are what he said about the superiority of Islamic practice to that of other religions, and about the impossibility of correcting heresy since it is deviation from the truth

This general statement may be filled out by one or two small points Thus, after speaking about the excellence of the Qur'ān (263/132), he mentions certain sectarians who quote things from their books—and it is implied that these are religious books—although 'God had created nothing of them (sc of what they say), either much or little' The translator of the book, Eduard Sachau, had some difficulty with this passage and failed to recognize the sect, but he correctly notes that this implies that al-Bīrūnī held that the Qur'ān was the eternal word of God What must also be noted, however, is that the word 'created' is contrary to the usual Sunnite view that the Qur'ān is the *uncreated* speech of God, and in line with Shī'ite, Mu'tazilite or possibly minority-Sunnite views

In another passage (31/15), after mentioning the 'abominable errors' of the common people among the Hindus, al-Bīrūnī speaks of doctrines in Islam which must be rejected, 'such as *tashbīh*, *ijbār*, and the prohibition of discussion in 'respect of some (religious) topic' The last phrase makes one think of the prohibition of discussions about the createdness of the Qur'ān by al-Mutawakkil *Tashbīh* or anthropomorphism is criticized by theologians of many schools *Ijbār*, however, or 'compulsion', meaning something like a denial of human free will, was a term applied chiefly by Mu'tazilites to the Hanbalites and other Sunnites and, within Sunnism, by the Māturīdites to the Ash'arites This might indicate that al-Bīrūnī had mixed in Māturīdite circles, since the Māturīdites were the chief rational theologians in the eastern provinces In other passages he is critical of Mu'tazilite writers of al-Jāḥiz for confusion in matters of geography (204/100, and of Zurqān (7/4) for errors about Buddhism

Finally it may be noticed that in a short *Risālah* dealing with the physician and philosopher Muḥammad ibn-Zakarīyā' al-Rāzī he attacks the latter's sympathy with Manichaeism and tells of his own great disappointment when after much searching he came across Mānī's book *Sifr al-Asrār* To a man like al-Bīrūnī who sympathized with the monotheistic trend in philosophy the dualism of Mānī would clearly be abhorrent

In conclusion may I express the hope that this short paper has shown that Abū Raiḥān was no mechanical collector and classifier of facts about other religions, but a thinker with a positive approach to other religions, in which they were seen as parts of a whole, though in a way which did not conflict with his acceptance of the truth of Islam

(The quotations are from Edward Sachau's translation entitled *Alberuni's India* (London 1888) The reference gives first the page of the translation, then that of the text (London, 1887) The relevant part of the *Risālah* about al-Rāzī may be found in D M Dunlop, *Arab Civilization to AD* 1500, London 1971, 237-9)

SCIENCE SECTION

TEXT AND TRANSLATION OF ṢAYDANAH AND ITS MANUSCRIPTS

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SAYDANAH of Bīrūnī is translated by al-Qaḍī Jalāl al-Dīn Abū Bakr ibn-'Alī ibn-'Uthmān ibn-Esfara at Kāsānī (Kāsān was a small city of Mavarā-al-Nahar, in the period of Sulṭān Iltutmish Shams al-Dīn Quṭbī the founder of Shamsiyah dynasty of Delhi) between 607—633 H The summary of the observations about the translation is as follows —

1 The translator has used a free translation form which was traditionally practised on most of the other books that were translated during that period

In this translation, some parts of the author's introduction especially the Arabic poetries, like discussion about (ابدال) Ibdal (change of the letter Cha (ح) to Sad (ص) and such other differences of Persian and Arabic languages were omitted

In the description part of plants and materia medica some items such as السی and اکسون are wholly omitted Besides those mentioned, some descriptions concerning certain items have been summarized, and in other cases some facts of the text have been misplaced in the Arabic to Persian translation Another aspect of the Persian translation is the absence of personal names such as Hamzah, Rāzī, Dioscorides in the item Ijjas (اجاص) (Prune) At the same time there are some added phrases whose sources are not mentioned We don't know whether the translator introduced those phrases from his own knowledge or he used it directly from the Arabic text, which was a different copy from the available Barsa's manuscript

2 It is evident that the translator was not very well versed in Persian literature which could be observed in the Persian poetries used in the introduction written by himself

3 The translator is not precise since many mistakes could be noticed in Persian translation, such as under آزاد درخت which he translated —

"ودرنا حبت جرجان بسیار بود اور ا زلون خواند"

In this verse, *alvan* (الون) is not correct, it should have been written in Persian as *van* (ون), because it is a Persian word

The other example is under ابراما مهز which is mentioned as —

" حوزانه زن بوده است در غایت فطانت "

(*Khurāneh* was a woman with intelligence), while *Khuzānah* is wrong and its correct form is *Khuz* Its Arabic text is —

" قالت الخوانه اسم فارس لحره "

this name was once used as *Khuzi*

The other example is about the description of اسقولو قندریون which is connected to اسقوروبوس Another example to show further variations in translation is under بهج item, which in Arabic text is —

" ویقال له فی الاستعمال بهج ابیض والذی زهره اصفر للتمهر "

in Persian —

" وعرب اور ابهج الدض گویند و آنچ شکوفه' او زرد است قمهر گویند

It shows that the translator has read the word تمهر wrongly instead of قمهر

4 Usually, translation has changed the personal pronoun (indicated as "Abū Raiḥān's thought") to the name of Abū Raiḥān

5 Concerning the words of Iranian dialect, we cannot be certain whether the record form of Arabic manuscript is correct or whether the words used are from the oldest available Persian manuscript

As an example, it is recorded under انزروت (anzarut)

" وبه زبان هندی حجوویه سحری زنحو و کوبرده گولم "

In Arabic it is " قال بعضرة کشره " which is possible to be read as کموده or کبزده In the record it is shown usually as " کوثورده "

This translation is however still an essential source and a definite tool for editing the Arabic text

Upto now, five different copies of Persian translation are in hand for editing of Persian version, and these are in addition to the two manuscripts of Aligarh and Muhammed Shafi Collection (Lahore) mentioned by Prof Anawati in International Congress of Bīrūnī (Teheran Sept-1973) and before him by Prof Nazir Ahmed in his informative article on Saydanah, printed in Indo-Iranica (1961) The combination and structure of four of the five manuscripts are the

same, while the fifth manuscript which is taken as the main copy does not have the same structure as the Arabic copy, and it also differs from the other four Persian manuscripts

The differences between the Arabic manuscript with the oldest copy of its Persian translation on one hand and four other newer Persian copies on the other hand, bring a new observation and view concerning the original text

Primarily, I must introduce the five copies here —

I Maghnisa (Turkey) ms which is oldest not only for its old paper and the style of calligraphy, but also due to the two notes of proprietors dated 845 H and 859 H In this case it belongs to the first half of the 8th century

This copy has numerous mistakes Its calligraphy is bad and difficult to read

This manuscript contains two distinct parts The first part is a description of the plants and other materia medica In terms of words used, it is a free translation of the available Arabic text manuscript in Barsa

The second part contains the occult properties of drugs (خواص مفردات) which are arranged alphabetically, meaning that they have been arranged in the same order as in the first part, but the contents are mixed with the first part in the other four manuscripts

II Manuscript of Parliament Library (Teheran), is probably copied in 9th century of Hijrah

III Isfahān manuscript (Farhang Public Library) dated 983H and copied by (شاه غیب الله سوسری)) Shah Ghayb Allah Sosari, from a manuscript by 'Umar ibn Muḥammad ibn 'Umar who was born in Kermanayah of Samarqand 'Umar ibn Muḥammad has written his manuscript in Khwārizm and has dated it as 737 H

IV Dehkhod manuscript (Sāzenān-e-Lughatnāmeh-i-Dehkhoda, University of Teheran) which is in a medical miscellany of 12 texts copied between 1006—1014 by Salek al-dīn Muḥammad Hamul-e-Ṭabīb

V British Museum manuscript copied by Khwājah Muḥammed Samī Dehlavī in 1109 H This manuscript contains many mistakes and is not as important as the others

Now I am going to explain about two interesting differences between the Arabic text (Barsa ms.) and the oldest Persian translation (Maghnisa manuscript)

The first difference is the existence of the occult properties of drugs in the Persian translation such as an independent part At the beginning of this part there are certain clear sentences from the copyist who relates this section to Abū Raiḥān By virtue of the following sentence it is difficult to make a distinction between the chapter and the existing Arabic text

"خواص ادویه مفرده ازین کتاب صیدنه که ذکر مصرفت رهیات و ایراد هریک کرده آمدست بر ترتیب حروف معجم از تصنیف بو ریحان ترجمه قاضی حلال کاسانی"

Existence of this section of Saydanah in the Maghnisa manuscript, and also the existence of the same contents in the other Persian manuscripts, including the lost manuscript dated 737 H mixed with the essential part, brings out the opinion that possibly the Saydanah had a Arabic text and this available manuscript is nearly half of it

For this reason it can be claimed that the Arabic manuscript is lacking the section of the occult properties

From the sentence under the item اغیرادون as follows -

و اورا به لغت تاری حلفا و بروی گویند و معنی حلفا و لوت و خاصیت او در باب حا گفته شود .

I also stipulate that most of the occult properties sections are based on the extracted thoughts of Abū Zayd Arrajānī, whose name appears in the introduction and in the several parts of the Arabic text

The second difference is the presence of some information in the Persian translation under the description of certain drugs which is lacking in the Arabic text, such as

Under آسیمه or آسمی in the Arabic text only الاردهالج is mentioned without having any other explanation or description But in the Persian translation we read

"به زبان فارسی آرد هاله گویند و سوس آرد گویند و معرب ارد هالج است و عرب آشامیدنی را سازند که از سوس به آرد سازند و عسل در و کند و اور الذمنه به آن سبب گویند که به شهر ساهت دارد"

Under اکمل الملک there is a sentence which is lacking in Arabic text The sentence is

"و نیکو ترین انواع اور امعدن به خلیفه ون است"

Under احیروس is written -

"هوالقمح البری غیر المیعا هد بالزرع والعمار"

But in Persian it is

" این حبوب را جو در گویند گندم دستی را الخیروس گویند و کشت و درودار معتاد نبود، و ادبی زراعت بروید و لوب او جون قوت گندم کشته بود و هر آنک این نوع از گندم کشته خشک تر بود بطبع "

At the same time it points out that the questioned word in Arabic same like قسهمه and it was positioned in such a way that the second letter is " ن ", but in the Persian translation under اجاص (Prune) many informations are omitted But instead, because of تسهنه and its similarity to the لبن (milk), we have edited it as تلهنه We could not find this word in the sources by the sentence as follows

" نوعی از و طری است آن را نوشق گویند "

A sentence is added " و سمه بر گویند و آن را اثلک خوانند "

Under ارميس the following Persian sentence is added

" و نام علوق (ollig) لعب رومی
علستهاست و هیأت و خاصیت او بعد ازین گفته آید "

Now, we can come up with a set of questions

Whether the translator had access to another Arabic manuscript of Şaydanah different from the Barsa ms ? In such a case the lost complete original text was more detailed

Whether it is possible that Abu Raihan without giving a description for تلهمه has recorded it in his work ? Or whether the translator has collected this additional information in the Persian translation from the other sources ?

Whether the translator has added his own experience and ideas to this work ?

Whether, if the Arabic text was more detailed than the present manuscript, then which one of the Persian translations could show us the real original Arabic text ?

Whether the Maghnisa manuscript has this qualification or the Isfahan manuscript, which is a copy from a manuscript dated 737 H ?

Unfortunately at the present there are no references to guide us to find the reason for these important differences

THE THEORY AND PRACTICE OF SCIENCE ACCORDING TO IBN SĪNĀ AND AL-BĪRŪNĪ*

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WE do not propose to study the work of Ibn Sīnā and of al-Bīrūnī in comparing their respective places in the historical development of the sciences We would like simply to characterize these two great spirits, less in relation to the science of their time than in relation to the idea which one could make of science in general

Even a slight familiarity with their works, the mere enumeration of the titles of their works, and the simple delimitation of the domains of their intellectual interests make us feel a very profound difference between these two men Avicenna has a more systematic spirit He attaches himself to the architectonics of the concepts He has from the very beginning a total confidence in rational thought which is for him the unique means of access to the truth itself, and consequently to all the particular varieties which fall under scientific investigation In this sense he is eminently a philosopher understanding thereby that he belives in a *philosophia perennis* capable of furnishing an ontological framework for the whole universe, and an epistemological framework for the universe thought He believes that these two frameworks superimpose themselves in making possible the application of a true theory to an efficient practice This is evident for anyone who considers his purely philosophical work But the same judgement imposes itself when one examines his purely philosophical work

Let us take as an example—because a complete examination of the question is here impossible—his *al-Qānūn fi'l ṭibb* The first declaration that we read is the following

"I have considered proper to speak first of general and universal questions in the two sections of medicine, the theoretical section and practical "

*The paper was originally presented in French at the Congress This is an English translation of it

As with regard to the theoretical portion, the practical is considered insofar as it falls under universal rules

The particular follows the universal both in being and in the method of knowing Though, of course, there is a radical distinction between the divine science and the human science, the ideal of sciences as such rests all the same on grasping the particular by the universal and in itself Avicenna continues: "After this I would speak of the universal conditions of the curative force of simple medicaments, than of their particular conditions" A little farther one reads "Then I have shown by pure theory, the universal traits of the ailments of the human body and the causes which produce them I have shown by which method one diagnoses them, by which method one treats them, and this always by a universal theory Then having dealt with these universal questions, I have turned my attention to particular maladies and this time again I have shown at first, for most of them, the universal condition in its definition, its causes and its symptoms (indices) Then I have been led to particular conditions Then, I have given the universal rules for the specific treatment of maladies, taking medicaments one by one, simple and compound" Let us remark well that Avicenna, even in the study of different maladies, begins by indicating their universal status It is not till the very end that he comes down (*nazalah*) to particular considerations which deal with individual objects

Let us give another example "Medicine," he says, "is a science of health, and of deviations from it, in a way to preserve it when it is there, and to work for its recovery when it declines" "But," he adds, "one may object that medicine is divided into a theoretical and practical part and since (alas!) we make of it an entirely theoretical knowledge when we say that it is a science" This is how Avicenna replies "When one has maintained that there is in medicine a theoretical and a practical part, one should not thereby understand that one of the two parts of medicine consists of learning science and that the other consists in doing practice On the contrary, it is proper for you to know that what one knows therewith is something totally different, that the two sections of medicine are only parts of one science, but the one is the science of the manner in which it is exercised This being so, one part has received the name of science and speculative research, the other the name of practice" The theoretical section consists solely in holding firmly what is established, what is useful to know, without undertaking to explain how it is necessary to intervene Thus it is convenient, for example, to know that there are three kinds of fever and temperaments As regards the practical, this is what Avicenna says "We take into account practice insofar as it is part of medical science, not practice in act (*al-'amal bi'fi'l*) nor the execution (*muzâwalah*) of corporeal movements, but that part of science whose knowledge gives a point of view useful in relation to the explanation as regards the manner of practice" Avicenna illustrates his thought by the example of the practical knowledge of the treatment of hot tumours and he concludes in the following terms, very revealing, indeed of the basic structure, of his thought.

"Once you have learnt these two divisions of medicine, you really possess the theoretical and the practical science of medicine, even if you do not do any practice"

The essentially speculative character of the thought of Avicenna appears once more in his frequent recourse to the conceptual philosophical framework For example, health is defined as habit (*malakah*) or a mode (*hal*) on the basis of which are produced on the part of the subjects (*mauḍū'*) of this habit or mode of actions without any defect (*sālimah*) (But it is not for medicine to discuss the value of this definition This is a question which concerns logic) One is taken to understand thereby a fundamental idea of Aristotle that particular sciences must receive their principles and the demonstration of their fundamental definitions from another science There is, then, for Avicenna a general architecture of scientific edifice to which one should refer constantly

Another example of this tendency to integrate scientific research in a logical and metaphysical framework is found in Avicenna in what he says as regards causes and their particular application to medicine If something has a cause, the science of this thing finds its fulfilment and completes itself only through the knowledge of its causes What are the causes of health and disease? Partly they are manifest and partly they are hidden and this is not through sciences but by demonstration (*istidlāl*) on the basis of accidents (*'awārid*) that one can reach them One should then know these accidents The material causes are in medicine the receptacle (*mauḍū'*) in which health and disease are produced This receptacle may be proximate as the organ or the spirit (*rūh*) or, may be more distant and these be the humours (*akhlāṭ*), and even more distant, and these be the elementary substances (*arkān*) These material substances have to do also with a composition (*tarkīb*) which comes into being by change (*istihalah*) and a unity (*wahduh*) results thereby, which again may be either temperament (*mizāj*) or structure (*hai'ah*) temperament with reference to change, structure with reference to composition As regards active causes, they are those which modify or which preserve the conditions of the human body These are, among others, the atmosphere, the nourishment, the nature of water or of drinks, the residence, movement and the repose of the body and the soul, etc The formal causes are temperament and composition The final causes are actions That one should know them it is necessary to know which are the forces which are active and which are the spirits which carry them In such a context, one knows that the practice rightly called clinical observations, independent of all philosophical presuppositions, as one finds them with the physician al-Rāzī, are assigned quite a secondary place

These objectives taken from the *Qānūn* suffice to show from what point of view Ibn Sīnā thinks and pursues his research within the universal conceptual framework that he gladly applies to the particular requirements of each object One could multiply the examples Let us confine ourselves

to say that if he is a neo-Platonist, Ibn Sīnā, nevertheless, follows very closely the logic and the methodology of Aristotle One has often remarked that the Stagirite had sharpened his spirit by his contact with the sciences of nature, and that Plato was influenced by the practice of mathematics But apparently one can say that even when he is inspired personally by the Aristotelian methodology, Ibn Sīnā is a thinker who takes as his starting point the empirical observations For him the inductions which lead to principles and to fundamental concepts from which science deduces, are already made by the Greek masters One has now only to take them again by increasing their number and deepening the nature of the particular facts which have to be subsumed under them Aristotle might say that one finds what a man is (for example) in Callias One could then say that Ibn Sīnā sees at first in a fact the general principles which organizes it and gives it significance He is not interested in the brute fact in its concrete singularity, in the fact which appears at first sight to be irreducible to what now is, which is consequently anomalous and which is, as such, for a true observer the occasion of new discoveries It is just the opposite of what we find in al-Bīrūnī To the difference of temperament of these two persons is added a difference in social origin and in education While Ibn Sīnā was the son of an employee of the Sassanide administration who gave him education carefully, al-Bīrūnī was born in a poor family of craftsmen Professor Belenitski has developed the idea that he must have cultivated his aptitude for the concrete manipulations and the use of instruments in this milieu In fact, al-Bīrūnī is suspicious of all general statements and he always seeks to verify correctly the facts which can be observed and determined through these generalities He lets himself learn about precious stones with the jewellers of Rayy and with the Greek travellers, he gets information about the medicinal plants cited by Dioscorides He interests himself in the works of al-Rāzī who was a great clinician At last, his prodigious knowledge of several languages gave him access to important works, especially Sanskrit, and allowed him to take himself on the spot for a proper investigation among the population of the countries through which he travelled

What needs to be pointed out at first is that his aptitude for exactitude leads him to place special trust in the mathematical method He appears to think that, outside the sciences in which this method has immediate relevance, it is the best method to follow in order to explain the ideas and the facts Unfortunately this is not always possible He writes in his book on India "To execute our project, it has not been possible to follow the geometrical method which consists in referring back to what has been said before and not what has been said later But in one of our chapters mention is made of an unknown fact whose explanation follows later" A regret marks this confession and one can infer that al-Bīrūnī had before him the ideal of a discursive thought-made-arguments linked together in a continuous fashion This makes one think of a Cartesian deduction, inspired by mathematics as also of the series of varieties which give certainly, provided we have gone through the links successively and have

preserved in memory how each one of them is connected with those which are most proximate, from the first to the last (*Regulatae ad directionem ingenii*), and, on the other hand, of the philosophy of Spinoza *more geometrico demonstrata*

It goes evidently by itself that if an object of science falls in the domain of mathematics, one should deal with it mathematically Thus having expounded the contents of the first 24 chapters of the astronomical work called *Brahma Sidhanta*, al-Bīrūnī, coming to the 25th chapter, says nothing In fact, he observes that the writer "expounds research made by means of speculative reflection without placing calculation before us I have made no mention of it here because the treatment by means of calculation exhausts the causes, and I think that the indications that the author gives in this chapter are the theoretical justifications of the operations (astronomical) how can anyone draw conclusion in this science (astronomy) by any other means than that of calculation?"

This quotation, while showing the importance that al-Bīrūnī attaches to mathematics as a science which 'exhausts' the causes and which consequently gives perfect knowledge with perfect certainty, reveals that this scholar in scientific matters has a tendency diametrically opposed to that of Ibn Sīnā He is not interested in the theoretical establishment of practical operations, *barāhīn al-'amal*, because he thinks that the *'amal* belongs, after all, to the domain of *'ilm* Curious indeed is the way in which the word *muzāwalah* is employed by Ibn Sīnā to designate the practical manipulation which he rejects and by al-Bīrūnī to refer to the practice of mathematical calculation which he recommends One might well say that this unique term with different indices of opposed values which Ibn Sīnā and al-Bīrūnī attribute to it, express exactly the difference in their spirit and their scientific sensibility

But if al-Bīrūnī is attached to this mathematical ideal it is not in the sense in which we said above of the Platonic metaphysics as inspired by mathematics It would be consequently an error to trace back the opposition between Ibn Sīnā and al-Bīrūnī to what separates Aristotle from Plato Besides, the positions of two Muslim thinkers, as regards Greek philosophy, cannot be compared Plato, Aristotle, Ptolemy and Galen are for Ibn Sīnā, masters of truth whom it is necessary to know, to think about, if necessary, to pursue their work in the same spirit as theirs For al-Bīrūnī, as we are going to see better and better, these sages and scholars of antiquity whom he knows equally well had the special merit of being able to isolate mythic thought from the rational and positive thought destined for an elite, repudiating totally the vain imagination and the fantastic representations of the vulgar, an achievement which the Indians were not able to complete because they remained subservient to popular mythologies He wrote "The Greeks have succeeded in having philosophers who lived in their country and who have brought into focus the principles adopted by an

elite to the exclusion of beliefs common to the masses because the elite are given to research and speculation, the vulgar to fall through haste and obstinacy if they are not subject to fear and dread " Thus what al-Bīrūnī appreciates in the Greeks is what one has called the Greek miracle, that is, the transition from myth to *logos*, initiated by Plato, pursued by Aristotle but which no one has ever completely achieved It is certain that in the eyes of al-Bīrūnī, the metaphysicians, though they pretended to be rational, still carried many mythic elements What he retains of the Greeks is the spirit of objectivity, of precision, of measure, in a word, the critical spirit It is not the systematization of metaphysics which is always premature

As regards Indians, they could not enjoy the same success inspite of the value of certain of their works Astronomy in particular, having, by its association with religion, a great importance for the masses, was the subject of such study as rebounded on the astronomers Wrote al-Bīrūnī "Their astronomers on their part made recompense by confirming the truth of their beliefs and by showing their accord with science This is why the two points of view (the vulgar and the scientific) got mixed up in the course of time, and the discourse of astronomy was affected adversely" It is the incontestable merit of al-Bīrūnī to have understood the fact that it was urgent and indispensable to subject to a merciless critique what is blindly received in the sciences (*taqlīd*), all that is transmitted by tradition (*akhbār*) and, in the end, only to admit anything which has stood the crucible of methodical verification (*madhhab al-tahqīq*)

In fact, for al-Bīrūnī, knowledge has two sources, both sensible, sight and hearing He writes in his *Mineralogy* "Among sensations of men, God has put both hearing and sight aside, given to him as the two means by which he could raise himself from the sensible to the intelligible What concerns the sight it allows itself to be elaborated by reflection on the sensible data in rapport with the effects of wisdom in the creation and to demonstrate the worker from his works As regards hearing, it permits us to listen to the word of God" One would observe that these declarations have the stamp of religious thought as al-Bīrūnī refers back to the *Qur'ān* But his faith does not alter, in the least, his scientific spirit What distinguishes precisely the Indians from the Muslims is, he says, that "the *Qur'ān* in all the questions which refer to an intuition which is necessary and rational (*darūrah*), speaks in terms which do not require an allegorical commentary (*ta'wīl*) to arrive at a truth rationally known In rational questions there can only be propositions exempt from ambiguity Besides, it does not contain anything which allows divergence" As distinguished from the religions of India, Islam does not fight shy of science

Besides, sight and hearing have a special importance in the acquisition of true knowledge In itself this idea is the expression of an empiricism which we find already in Aristotle Science is acquired by an experience which is essentially visual, and is transmitted by an information, oral in its principle, but which can

be written, because, writes al-Bīrūnī, "writing is its species" But what distinguishes him is the profound reflection which he has made on the oral transmission, the hearsay, the *khabār* One reads in the beginning of his book on India· "If one is justified in saying that what is transmitted by hearsay is not like the direct witness of sight (*'iyān*), it is that the visual witness is the capture of the thing observed by the one who has observed it, at the moment where it exists and in the place where it is produced If it were not for the defects which are associated with the oral information, it would have an apparent superiority over the witness of sight and over the visual observation which is confined to the existence, enclosed in every moment of time while the *khabār* takes hold of the present existence as well as the past which precedes it and the future which follows it so that the *khabār* extends it at once to the present existence and the non-existence (which is no more and which is not yet)"

Al-Bīrūnī has understood a fact which is most apparent but little taken into consideration That is, it is necessary to distinguish knowledge which comes from direct experience and knowledge which comes from indirect experience

They are often mixed but only the first has an immediate value if the view is not falsified by prejudices Now among the veils which distort the clear view, language is to be particularly mentioned That one should go from the sensible particular to the intelligible general, or from the general to the particular, one has to pass through the intermediary of language Now language is not, as it is often believed, an aggregate of denominations applied to the denominated, that is to realities designated by experience Such a language, founded on bi-univocity, with one word for everything and one thing for every word, would serve the perfect scientific language It is then the mathematical language, this is what certainly al-Bīrūnī thinks about, when he criticises the super-abundance of Sanskrit words "The Indians", he writes, "are very happy for a language which has the greatest defects The function of the language is to apply a name to every one of the beings and to each one of their effects, by a convention among men, thanks to which one could understand what the others would say when they use this name in speaking"

There could be dialectal differences which multiply the words But apart from this case if nothing justifies the plurality of vocables, and if a single word could suffice then, says al-Bīrūnī, "one has to consider the superfluous as prolixity, redundancy and prattle, because it has become the cause of blindness and dissimulation" Unfortunately, language is far from being the perfect instrument of science It is the bearer of all the effective changes, characteristic of the nation which speaks it It is linked with its history, its mentality, its spiritual culture and its material civilization It expresses more the human reaction in its encounter with reality than reality itself In studying India and other nations he could observe in concrete the influence of social factors He has realized how necessary it is to save the scholar from the snares of his own language

But he does not rest satisfied with general considerations In the same critique he does a scientific work and he foresees vaguely what could well be social psychology and linguistic sociology as prolegomena to all scientific discourse, he explains his thought through concrete examples One would find it on almost every page of his *India* and *Chronology* We will give only one example concerning the succession of numbers In the denomination of numbers, the Indians go beyond the order of thousand (*martabat al-ulūf*) Their language goes beyond the expression of the 18th order beginning with unities and they call it *parardha* The names of the orders are partly improvised (*muqtadabah*), partly derived (*mushtaqqah*) They stop there for religious reasons (*li-asbab milliyyah*) and the language is made here the interpreter of religion Nevertheless, certain people introduce a 19th order, called *bhuri*, equally justified by beliefs "Beyond this order", writes al-Bīrūnī, "there is enumeration (*hisāb*)" But he adds, "the enumeration is unlimited, or if it is limited it is because of an institution of names which puts an end to the series of orders of enumeration This is then as if by the term *hisāb* one expresses the denomination Symbols go much further and are much more universalisable than the expressions of which the language makes use of, however extended the creative powers might be"

In insisting on the differences of the language and consequently on the differences on the mentality and customs, al-Bīrūnī does not allow himself to be led to sceptical relativism

He is convinced of a universal scientific truth for all men It is at the level of general metaphysical conceptions that one finds the divergences between nations and civilizations If philosophy loses the prestige of an assumed universality, science, in proportion to its separation from it, preserves the exclusive privilege of attaining truth Sciences do not differ among themselves from one country to another, except in the degree of impurity, that is to say, in proportion to non-scientific beliefs which they still carry

Nevertheless, all these beliefs which from the point of view of science are only myths without any kind of objective truth are not as such deprived of reality Hence they must become the object of scientific scrutiny Here also al-Bīrūnī has taken a new step and may be considered the Father of Comparative Mythology, of Comparative History of Religions and of Ethnography It is at this level that he compares the Greeks with the Indians His information concerning the thought and literature of the Greeks appears to be not in comparison with that which Ibn Sīnā might have had Ibn Sīnā refers only to philosophers from whom he had borrowed the elements of his system or to scholars who have guided his interest in scientific question Al-Bīrūnī cites the Seven Sages, Plato, Aristotle, Ammonius, Proclus, Appollonius of Thyane, John the Grammarian (Philoponos), Aratos and his praise of Zeus in the beginning of *Phenomenes*, Homer etc These quotations are all in accord with his exposition of the beliefs

which have nothing scientific in them However, it happens that he has to rely on Aristotle but he is interested more in the founder of the peripatetic philosophy than in the astronomer, author of a theory of the Heavens and of the movement of the spheres It is equally the scholar whom he considers when he quotes Galen (except when he draws from him the information about the beliefs of his times)

But all the authors including Plato are introduced as the witnesses of ideas which al-Bīrūnī studies rather as objects, the products of the human spirit rather than of truths from which one needs to be inspired directly

Let us note that however absurd some of the beliefs may appear to be, al-Bīrūnī often appears to think they have a *raison d'etre* and that one can explain them Here is, what he says about charms and incantations "I do not know what to say of them as I do not give credence to such kind of things But I have known a person, a sceptic, who was given to doubt in what exists and far from believing in such nonsense He was once poisoned and he narrated to me that he got in touch with Indians qualified in such affairs They modulated on him their incantations and just then he recovered and felt cured through the gestures which the magicians made with their hands and their rods I have myself seen the hunters (who by their incantations) took the gazelles with their hands I have not found in their practice anything other than the habit which becomes effective in these animals and which was due to the constant repetition of the same melodic theme" "One can deny the interest of such an attitude which consists in regarding all that exists, like the most extraordinary dream, as worthy of being studied and explicable by causes" One sees then the interest of al-Bīrūnī he is modern, he is ahead of his times Without doubt he has not erected a vast system like that of Ibn Sīnā, without doubt his attitude is far from satisfying all the needs of the human heart What he says, for example, about Sufism, the way he analyses and exposes its ingredients, whatever interest this might present otherwise, would only result in making us regret the religious thought of Ibn Sīnā

But one has to deal with two types of men, with precisely marked characters One might well prefer the one to the other One can assess differently the services which they have rendered to man's thought We did not like to follow this way But what is certain is that al-Bīrūnī's is a personality amazing for his times, a personality that retains even for us who study it, one of the most powerful attractions

THE KITĀB AL-JĀMAHIR FĪ MA'RIFAH AL-JAWĀHIR OF AL-BĪRŪNĪ

G C ANAWATI

I had the honour two months ago to present a brief critical analysis of the *Kitāb al-Ṣaydanah* of al-Bīrūnī and to expound the problems which face the scholar concerning its edition in a scientific way I would like today to present the other book of al-Bīrūnī, *Kitāb al-Jamāhir*, written at almost the same old age, i e, when al-Bīrūnī was eighty years old, and which is as important, if not more so, as the *Kitāb al-Ṣaydanah*

Despite its exceptional importance, this book has not received the attention it deserves, as remarked by M Plessner in the new edition of *Encyclopedia of Islam* Yet the book, to quote Prof Hossein Naṣr, "is the most complete medieval text of mineralogy, it contains the description of minerals and metals from all over Asiatic, European and African continents" (*Introduction to Islamic Cosmological Doctrines*, p 148)

In the very brief time alloted to me, I would like to contribute modestly to a better knowledge of the *Kitāb al-Jamāhir* in accordance with the following plan

1 Give some details concerning the authenticity, the edition and the translation of the book

2 Analyse briefly the contents of the book, comparing it with other similar books in Arabic literature

3 Give some sources of the book and indicate its further utilisation by Muslim authors

4 Point out to some scientific problems raised by al-Bīrūnī

5 Finally conclude with some practical suggestions concerning what can be done about this book in the near future

I. *Authenticity, Manuscripts, Edition, Translation*

Concerning the authenticity of the book, we can be very brief Its attribution to al-Bīrūnī has never been contested, as far as I know I will quote only the text of Ibn abī 'Uṣaybi'ah v 2, p 20)

" ولابى الريحان البيرونى من الكتب كتاب الجماهر فى معرفة الجواهر
يتضمن الكلام فى الجواهر وانواعها وما يتعلق بهذا المعنى الفه للملك
المعظم شهاب الدولة ابى الفتح مودود بن مسعود بن محمود "

which means "and among the books of Abū al-Raiḥān al-Bīrūnī is the *Kitāb al-Jamāhir fi Marifah al-Jawāhir* (The sum of knowledge about precious stones) which contains explications on the precious stones and their kinds and anything in connection with this He composed it for the Honoured King Shihāb al Dawalah b al-Fatḥ Mawdūd b Mas'ūd b Maḥmūd"

Al-Bīrūnī himself affirms exactly the same thing in the introduction of the book He says that he composed it in order that it will be

" تذكرة لى فى خزانة الملك الاجل السيد المعظم المؤيد شهاب الدولة
وقطب الملة وفخر الامة ابى الفتح بن مسعود بن محمود "

In addition to this, we find many quotations of the *K al-Jamāhir* in Arabic literature, for instance, in the *K al-hikmah* of al-Khāzinī, in *al-Durr al-miknūn*, and *al-Nihāyah* of Jildakī, in *Nukhaū al-dhakhā'ir fī ahwāl al jawāhir* d'Ibn al-Akiffā'ī

As for the book itself, the first orientalist to have taken interest in it was Prof Paul Kahle who published in the *ZDMG*, in 1934, an article entitled "Islamische Quellen zum chinesischen Porzellan", in which he gave a translation of the few pages of Biruni describing *al-qiṣā' al-ṣīnīyah* Presumably in the desire to have more details on the subject, he encouraged one of his Syrian students, Muḥammad Yaḥyā Haschmī to take for his "Doktorwurde" a study of "Die Quellen des Steinbuches des Beruni s" (The Sources of K al-Jamāhir of Bīrūnī) The thesis was published in 1935 It represents a booklet of 48 pages

Haschmi utilised the three manuscripts which were available to him the one of Escorial, the second of Top Kapi Sarai written in 626 H, the third of Rashīd Effendi in Qaysarīyah

In 1355 H, the German orientalist, Fritz Krenkow, published at Hyderabad the Arabic text of *Kitab al-Jamāhir*, in 270 pages, based on the three extant manuscripts just mentioned But Krenkow complained that numerous difficulties had prevented him from identifying many geographical places and the exact orthography of persons

Meanwhile, some other chapters and paragraphs have been translated In 1936, Prof P Kahle translated the chapter concerning rock crystal and glass In 1941, Taqī al-Dīn al-Hilālī translated into German the introduction of the book In 1941, Fritz Krenkow translated into English the chapter on pearls, and, in 1950, Belenitsky translated into Russian the article on Kahruba (electron) In 1968, Spitaler published in the *Festschrift Werner Caskel* some pages of literary and philological interest

Finally, in 1963, a Russian scholar published a Russian translation of the entire book with a long technical introduction concerning mineralogy among the Arabs (of Bibliography)

II The contents of the book

Let us see now the book itself It is composed of three parts

(1) A first part, which we can call the "Introduction", although it does not bear this title It makes 32 pages of the prined text

(2) A *maqalah* (or section) on precious stones of 200 pages

(3) A second *maqalah* on metals (*filizzat*)

By contrast with the introduction to the *K al-Saydanah*, that of *K al-Jamāhir* is rather puzzling there are no titles, no indications of the method adopted Bīrūnī begins with a *dibajah* which here, apparently, has nothing to do with the subject of the book, it is a sophisticated praise of and a warm admiration for the wisdom manifested in the creation Then a *faṣl* describes the degrees of the different kinds of creatures (*al-makhlūqāt*) God gives to each kind what is necessary for it the plants need only a small quantity of nutrition which comes entirely by means of their roots, fixed in the soil, unable to move On the contrary, animals have to move in order to satisfy their needs and God gave them the five senses to enable them to reach their aim

After this initial *faṣl*, fifteen *tarwīhah*, varying for each one from ten lines to six pages, give progressively the situation of man towards nature and how he has been led to use gold and silver and to adorn himself with jewelry

Man surpasses other animals not by the acumen of his senses but by the possession of intelligence by virtue of which he is God's vicegerent (*Khalīfah Allah*) on earth

" فان نوع الانسان قد فضل جملة الحيوان بما شرف به من قوة العقل حتى
اكرم بمكانها و رشح للخلافة في الارض على التعمير و اقامة السياسة فيها و
لهذا ذلت له طوعا و كرها فانقادت مسخرة لمصالحه ليلا و نهارا " (ص ٢)

The highest senses of man are hearing and sight, the three others are rather for the body, the first two are more spiritual, they lead man from the sensible to the intelligible world Bīrūnī says "Sight connects what we see to the signs of Divine wisdom in creatures and demonstrates the existence of the Creator from his creation," (p 5)

" اما البصر فاعتباراً بما يشاهد من آثار الحكمة في المخلوقات و الاستدلال على الصانع من المصنوعات "

Once he has established the place of man in the world, Bīrūnī comes to the needs of society Every species feels at home with its equals and birds congregate with birds of their kind

" ان الشكل الى الشكل يسرع و الطير مع الافها تقع "

Marriage is a necessity, it is at the base of multiplication and leads to the constitution of communities living in villages and towns

Being composed of opposing humours, man needs a principle of cohesion in order to keep the opposites together The parts try to separate and to put away the coercion This is the source of evil and disease Because of weakness and poverty, man is subject to trials So he has to be protected The needs are varied, man alone cannot satisfy them Hence for him the necessity to live in a community, and this is the source of *tamaddun*, or civilisation

It was the wisdom of God which distributed men in different parts of the world, otherwise the small quantity of goods would have disappeared quickly and the equality of all would have led to the destruction of all

As the goals and the desires of men are different, so also are the professions and the arts In the beginning, people arranged themselves to render mutual services to each other, one compensating by his work what the other has done for him But afterward, men felt the necessity to find something which would be acceptable by all as a medium of exchange at the place of these mutual services The multiplicity of goals, the difference in time for the fabrication of things, and the fact that one did not need what the other was offering—all these factors incited men to find general values instead of particular, services They chose what had an agreeable aspect, that was precious, rare perdurable

And God, before creating man, provided him, in the depths of the earth, with *mawzūnat* "what is weight", i e , gold and silver in order that he will be able to use them Bīrūnī is aware of the danger of accumulating gold and silver He notes that the respect for gold and silver professed by man is artificial and accepted by common agreement وضعا لا طبعا و اصطلاحا فيما بينهم لا شرعا

because in themselves they are mere stones which are unable to calm a hunger, to quench a thirst, or to preserve from evil

Then Bīrūnī devotes long pages to analyzing the virtues of *murū'ah* (which is a mixture of courage, generosity and sense of honour) and *fūtuwwah* (chivalry) He shows the propensity of man to exalt himself by adornment and decoration (*al-zīnah*), handsome garments and perfumes (*al-nazāfah*), jewelry; and also the way in which kings and princes have been led to accumulate very precious stones in order to compress their fortunes into a little volume He speaks of the prohibition made by the Qur'ān to drink water in golden cups and explains this prohibition

After all these *tarwīhāh*, Bīrūnī comes to the second *faṣl*, saying that he wants to enumerate the precious stones conserved in the treasuries, this will constitute a *maqala* And there is another *maqala* for the *filizzāt* which are the metals

In order to give to the reader a precise idea of the contents of the book, I give here below the table of its contents, indicating also the pages of the printed text

المقالة الاولى فى الجواهر

رقم الصفحة	
٣٢	اليا قوت
٣٩	قيم الجواهر الخفيق
٥١	اشباه اليواقيت
٥٣	احجار فى اليواقيت و الجواهر
٦٣	باب سائر الوان الجواهر و اليواقيت
٨١	ذكر اللعل البدخشى
٨٨	البيجا دى
٩٢	الالماس
١٠٢	السباذج
١٠٣	اللؤلؤ
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ذكر ما عرف موضعه من معادن اليمن الحجريه
والترابيه فى الخلقة

III—The sources

We can distinguish two kinds of sources for *Kitāb al-Jamāhir*, the direct and the indirect

1 Direct sources

I mean by direct sources the books or the information which Biruni himself quotes as have been utilised by him For instance

(a) *The Kitāb al-ahjār* of al-Kindī considered by him as "Imam al-mujtahidīn"

(b) The book of Naṣr ibn Ya'qūb al-Dināwarī al-Kātib Bīrūnī says that Nasr has followed Kindī for most questions

(c) The jewellers (cf list in Hāschmī, pp 14-15)

(d) His personal experience and experiments (see for instance, what he says about the emerald)

2 Indirect sources

The indirect sources consist of what has been utilised by Kindī and Naṣr, for instance, the notices of Theophrastes, Pseudo-Aristotle, and Dioscorides I will mention only the part of the *Materia medica* of Dioscorides which is devoted to minerals I give the names of the minerals and their number as they are mentioned in the English translation by John Goodyn (1655) (cf the Bibliography) Their amount is almost one hundred

84 Calamine
85 Pompholyx (a deposit in smelting furnaces)
86 Antispoda (ashes used instead of spodium)
87 Burnt copper
88 Flowers of copper
89 Scales of copper
90 Smithy scales
91 Verdigris
92 Ios skolex
93 Iron rust
94 Iron slag
95 Washed lead
96 Burnt lead
97 Lead dross
98 Lead stone
99 Antimony sulphide
100 Galena or lead sulphide
101 Silver-dross
102 Litharge
103 White lead
104 Malachite Chrysocolle
105 Copper carbonate
106 Kuanos (Lapis lazuli)
107 Indigo
108 Ochre Litharge
109 Cinnabar

110. Quicksilver
111. Red earth of sinope. Bolus armeneus
112 Red ochre Terra sigillata
113 Lemnian earth
114 Copperous water
115 Copper ore
116 Psorikon
117 Copperas
118 Blacking
119 Ink-stone
120 Tutty
121 Orpiment
122 Realgar
123. Alum
124 Sulphur
125 Pumice
126 Salt
127 Sea-foam
128 Salpetre
129 Soda
130 Native soda
131 Nitron aphros
132 Lees of wine
133 Quick-lime
134 Gypsum
135 Sarmentian ashes
136 Casting of king-fishers, etc
137 Calcium chloride and other salts
138 Sponges
139 Isis nobilis
140 Antipathes formiculaceum
141. Pumis with alum
142 Asios lithos
143 Copper pyrites
144. Maematite
145. Ibid
146 Fossil bitumen
147 Trakios lithos
148 Load-stone
149 Arabicos lithos
150 Chalk
151 Honey-stone
152 Soap-stone
153 Gypsum
154 Turquoise
155 Fossil spines of sea urchins
160 Jasper
161 Eagle stone
162 Snake-stone
163 Lithospogon
164 Lithokolla
165 Fossil oysters
166 Emery
167 Sand
168 Whetstone
169 Geodes lithos
170 Earth
171 Terra eretria
172 Terra samia
173 Lithos samios
174 China earth
175 Selinousia
176 Cimolian earth
177 Potter's clay
178 Tiles
179 Ge kamion
181 A bituminous earth
182 Soot
183 Black Ink

The second book which had had a great influence is the *Kitāb al-aḥjār*, falsely attributed to Aristotle and which has been especially studied by Ruska. Here is the list, in Arabic, of the minerals mentioned in the book

الدر
الزبرجد
الياقوت
السحاذى
العقيق
الجزع
الذهنج
البادزهر
الماس
السبادج
الفيروزج
اللازورد
السبج
العنبرى
المغناطيس
مغناطيس الذهب
مغناطيس الفضة
مغناطيس الصفر
—
مغناطيس الرصاص
مغناطيس اللحم
مغناطيس الشعر
مغناطيس الاظفار
الكرك
مرقشيثا
مغنيسيا
الكبريت
الزرنيخ
المرقى

المهاه
المغناطيس
حجر ليسهل الولاده
حجر السمك
حجر يجلب النوم
حجر ينفى النوم
حجر عحيب
حجر عردب
حجر يسمى الفيرى
الحجاره الحيوانية
حجر الاندا'
حجر الاورام
حجر البلور
حجر الزجاج
حجر الملح
حجر البورق
حجر النوشادر
حجر النطرون
حجر الراح
حجر الشب
حجر الطلق
حجر الاثمد
حجر التوتيا
حجر المرجان
حجر القيشور
حجر بحرى حيوانى
قلقشيت
حجر الذهب

الفضة	حجر ليه تخطيط
النحاس	الحاسر
الرصاص	المركبات
الزئبق	الاسرنج
الحديد	الزنجفر
التنكار	الاسفيداج
المس (الحجر الاحمر)	الزنجار
—	خبث الحديد

There are also other authors who have been mentioned, for instance, Jāḥız, Jābır ıbn Hayyān, Muḥammad Zakarīyā' al-Rāzı, 'Uṭārıd b Muḥammad mentioned as having written a book on the magical properties of the stones

Geographical sources are mentioned in seven passages, the authors quoted are al-Iṣṭakhrī, Ibn Khordhādhbeh, al-Maqdısī ıbn al-Faqīh (cf Hāschmī, pp 20-31)

Bīrūnī also analyzes very carefully the names of minerals from the philological point of view He mentions authors like al-Khalīl b Aḥmad, al-Asma'ī, al-Farrā', Abū al-Hasan al-Lıhyanī, Abū Hanīfah al-Dınāwarī (*Kitāb al-nabāt*), Hamzah al Isfahānī, Ibn Jınnī, and many others (cf Hāschmī, pp 21-26)

Poets cited are from the Jāhılīyah 12, from the time of the Prophet 8, from the period of the Umayyıds 22, that of the Abbassıds 23, others 19, (cf Hāschmī, pp 27-30)

The Persian authors are quoted Ghadā'ırī from the time of Maḥmūd of Ghaznah, Manṣur, Ibn Mandawayh (cf Hāschmī, pp 30-31) Only one Indian author is mentioned Susruta for his medical book The Syrian and Alexandrian sources are Yaḥyā b Masawayh, Bakhtıshu' b Jıbrīl, Yaḥyā al-Naḥwī

Greek authors other than Aristotle and Dioscorides Archimedes, one time for rock crystal, Apolonos of Tyane, Plutarchos, Ptolemeus whom he considers as his model Ptolemeus has been obliged to ask from some travellers details in order to elaborate the tables of longitudes and latitudes But he remarks that often the travellers are not reliable

Without being able to affirm that the authors who came after Bīrūnī utilized the *Kitāb al-Jamāhir*, we give here the contents of two authors who wrote on minerals one contemporaneous to him, Avicenna, the other after him, al-Tıfāshī

Avicenna dealt with mineralogy in his huge philosophical encyclopedia of philosophy, *Kitāb al-Shifā* The part devoted to the formation of different minerals has been translated into English by Holmyard (cf the Bibliography) A systematic list of the minerals used in medicine is given in the *Canon*, it is included in the *Materia medica* along with the plants and medicines from animal origin We extract minerals and give that list separately

اثمد
الابار و الانک
اشان
اسفيداج
الماس
بورق
جص
وسخ
زئبق
زاج
زرنيخ
زنجفر
زجاج
زفت
زنجار
زهرة النحاس
حديد
حجر اليهود
حجر الاسفنج
حجر الرحى
حجر المس
حجر على
حجر القمر
حجر اسميطوس
حجر حبش

حجر الروحي
حجر يطالا، بالريت
حجر اليشب
حجر الاسكالته
حجر ارمني
حجر الصخر
حجر المثانة
طباشير
طلق
طين مختوم
طين مطلق
طين ارمني
طين شاموس
طين ماكول
طين بلد المصطفى
طين قيموليا
طين الكرم
طين المقره
طين الارض المرروعة
طين سماعي
كبريت
كلس
لازورد
الماء
مرداسنج

مغناطيس
صدأ الحديد
مارقشيشا
قطران
مغنيسيا
اقليميا الذهب
مداد
قلقطار
موميا
رماد
ملح
رصاص
نطرون
ريتاج
نورة
شب
نوشادر
توتيا
نحاس
تنكار
نفط
توبال
عظام
ثلج
عكر الزيت
حرف
فضة
ذهب
صدف
عاغاطي
صابون
عراء

كتاب ازهار الافكار فى جواهر الاحجار

لاحمد بن يوسف التيفاشي

١ - الجواهر
٢ - الياقوت
٣ - الزمرد
٤ - الزبرجد
٥ - البلخش
٦ - المغنيسيا
٧ - الحادي
٨ - الماس
٩ - عين الهر
١٠ - البازهر
١١ - الفيروزج
١٢ - العقيق
١٣ - الجزع
١٤ - المغناطيس
١٥ - السنباذج
١٦ - الدهنج
١٧ - اللازورد
١٨ - المرجان
١٩ - السبج
٢٠ - الجمست
٢١ - الخماهان
٢٢ - اليشم
٢٣ - البيجاذي
٢٤ - البلور
٢٥ - الطلق

وسبيلنا ان نتكلم على كل واحد من هذه الاحجار المعدودة بشرح ما له من لغة العرب من خمسة اوجه :

الاول - ذكر علة تكوينه في معدنه
الثاني - ذكر معدنه الذي يتكون فيه
الثالث - ذكر جيده ورديه
الرابع - ذكر خواصه ومنافعه
الخامس - ذكر قيمته وثمنه

IV *Scientific problems raised by al-Bīrūnī*

1 The origin of minerals and metals Al-Bīrūnī follows the exhalation theory and more specifically the sulphur-mercury theory of Jābir ibn Hayyān

2 The rejection of transmutation Though he believes in the growth of minerals and the progressive formation in nature of metals into gold, he categorically rejects alchemy itself

3 The determination of specific density In his *Commentary on Maqāsid Sharh al-Maqāṣid*, Ṣa'd al-Dīn al-Taftazānī has described the apparatus which permitted Bīrūnī to evaluate the density of different minerals He says that it was composed essentially by a receptacle of a conical form, having at the superior part an overfall Bīrūnī filled the receptacle with water and then dropped in one hundred *mithqal* of gold, after having placed the scale of a balance under it He evaluated in this manner the weight of the water displaced He repeated the experience with all kinds of metals and rocks Before that, he was careful to purify the mineral and the water he had drawn from the Amu Darya in autumn It is clear, he said, that the results obtained depend upon the nature of the water used, upon the regions from where it comes, and upon the temperature of the season We can observe, he added, that the smaller the density, the greater the quantity of water displaced (for a same weight)

One can appreciate the precision of this method and Bīrūnī's cleverness in experimentation in observing that he was able to determine that the relation of warm water to cold water is 0 041677 (cf A Mieli, *La science arabe et son role*, 1938, pp 100-101)

Conclusion

I should like to conclude by making some suggestions

1 The book of *al Jamāhir fī ma'rifah al-Jawāhir* has to be re-edited carefully, with the help of several specialists from different disciplines

2 A good study of the method of determination of specific density must be performed starting from the works of Clement-Mullet and Wiedemann (cf Bibliography)

3 It is desirable to translate the book in an accessible language

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GEOGRAPHICAL PLACES VISITED BY AL-BĪRŪNĪ

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As we now know, Bīrūn is a small village in the suburb of Gorganej* where Abū Raiḥān was born and from there he moved soon to the main town and spent his boyhood as well as a part of his youth Later on he travelled to Gonahad Qābūs, a town on the Caspian shore, where he stayed for sometime before he returned to Gorganej again Therefore, this city is one of the most important abodes of al-Bīrūnī It was in this city that al-Bīrūnī was greatly patronized by Abū al 'Abbās Ma mūn ibn M'aṣūm who was brother-in-law of the famous Sulṭān Maḥmūd Ghaznavī Here, I will try to give a brief account of Gorganej

The geographers have mentioned this city by different names as shown by the title of this article Khwārizm is the name of the province and Jorjanieh was its capital and that was the Arabicized word for Gorganej The first Islamic geographer who mentions this town is Hamd Allah Mustaufī He calls it the City of the Elephant and the City of Manṣūrah (conquered) The city was conquered in the seventh century by Moslems Ibn al-Athīr is another Moslem geographer who gives an account of this town *Ḥudūd al-'ālam*, another famous geographic text whose author is unknown mentions Gorganej, as an important trade center Ibn-e-Baṭūṭah of Tangiers as well as Iṣṭakhrī, both give vivid description of this town All of them agree that the town had wide streets, magnificent palaces, plenty of gardens with fruits and vegetables They all mention that it was full of caravanserais and warehouses The town was irrigated by one of the tributaries of Amū darya Mosques, bazars, theological schools and bimarestans (hospitals) abounded in the city The population was mainly Khorasāni and they spoke a dialect of the Greater Khorāsān, then prevalent in the eastern province of Iran In this way, there remains no doubt of the origin of al-Bīrūnī and he is definitely of the same Iranian stock as Avicenna and Fārābī

Abū al-'Abbās who married his brother's wife upon the death of the latter became related to Sultān Maḥmūd After this marriage, he was detested

*Gorganej — Jorjanieh — Organj — Khwarizm

by the people of Khwārizm, as well as the dignitaries of his own court, who plotted against him and assassinated him in 407 Hijri As a reigning monarch he was unsuccessful but as a patron of learning, his name remains outstanding Besides al-Bīrūnī he patronized famous physicians and philosophers as Abū 'Alī Sīnā, Abū al-khayr Khammār, Abū Naṣr 'Irāqī and Abū Sahl Masīḥī Thus, his court became a great center of research and learning and rivalled that of Ghaznah and Toledo of Alfonso the Sage in Spain, or the one of Qābūs Washmagir in Gorgan Ma'mūn's court became so outstanding and its fame spread far and wide so that Sulṭān Maḥmūd sent emissaries to invite these learned men to his own presence The story runs that Ma'mūn summoned the learned philosophers and physicians and told them of the Sulṭān's request He thus gave them the choice of going to Ghaznah or escape to other towns Al-Bīrunī chose to go to the Sulṭān Ghaznah is then another important town to be visited by this great scientist and philosopher

GHAZNI OR GHAZNAH

According to *Hudūd al-'ālam s*, Ghaznah is a frontier town between India and Islamic world It is a great trade center situated in the province of Sīstān Iṣṭakhrī mentions it in the same way adding that it is situated on the slope of a mountain and a creek passes through the town There are lots of gardens and grooves and plenty of caravanserais as well as bazars Ibn Hauqal, another Islamic geographer, describes its resemblance to Bāmiān giving a vivid description of its commercial centers and the wealth of its inhabitants Alaptagin, Maḥmūd's father chose it as a camping center in 355 Hij Upon his return from India, Maḥmūd established his capital in Ghaznah and embellished it with magnificent palaces and public edifices During his time, Ghaznah rivalled Baghdad in splendour and grandeur It is exactly in this period that al-Bīrūnī arrived in the court of Maḥmūd, where he was received with various attitudes according to the king's dispositions Once, he was even condemned to death, because he had predicted what the king would do next Later on, al-Bīrūnī fell in great favour with the king and accompanied him to India where he came in contact with the Indian sages and fakirs In India, he visited quite a number of small and large towns which he mentions in his famous treatise called "TAḤQĪQ MA LI AL-HIND MIN MAQŪLAH MAQBŪLAH FĪ AL-'AQL AU MARDŪLAH" In brief, these name places are

"Ghaznah, Kābul, Gandi or Gandomak, Dinward or Jalalabad, Lamghān, Purshur or Peshawar, Vihindia, Atak, Jalun, Sialkot, Lahore, Nandana, Tilla and Mindelkur or Minhukur"

These geographical places comprise the valley of Kabul and Punjab He has not been to Kashmir, but only visited the south-west frontier of that famous province He has gone as far as Rajgiri and passed through Lahur Multān is definitely another important center visited by al-Bīrūnī as he describes

it in full, mentions its climate and its festivities Multān is the place in which the hours are marked by the sound of cymbals and trumpets

While staying in Ghaznah and enjoying the favour of Maḥmūd, al-Bīrūnī pays several visits to his native land, Khwārizm He is an eye-witness of the uprising and insurgence of the people against his beloved patron, Ma'mūn; in which he is murdered As I mentioned before, he migrated to Ghaznah after this incident and stays there for the rest of his life "*Bet'arikh Khwārizm*" is another important historical work written by al-Bīrūnī in which he relates in full the history of Ma'mūnians in his native land Bayḥaqī, the famous historian of the Ghaznawians quotes from al-Bīrūnī

Maḥmūd died in April 1030, equivalent to *Rabi' al-thānī* 421 in Ghaznah where he was buried, but al-Bīrūnī stayed and witnessed a great quarrel between two sons of Maḥmūd, Moḥammad and Mas'ūd The two brothers met in Takin-abad near Herat in which Muḥammad was betrayed by his own uncle, seized and handed over to Mas'ūd who blinded him Thereupon, al-Bīrūnī stayed in the court of Mas'ūd and wrote "*Qānūn Mas'ūdī*" in the name of this king As we know from the history, Mas'ūd never rose to the height of his father He was despised and hated by his court and generals and was soon defeated in a battle with Saljūks Soon after this battle, Mas'ūd was assassinated and the kingdom was inherited by his son, Maūdūd Al-Bīrūnī continued to stay in Ghaznah where he died on *Rajab* the 2nd 440 Hij He was born on the 3rd of *Dhū al-Hijjah* 362 in Khwārizm and died in Ghaznah So, he lived seventy-eight years

Summing up, the works, life and geographical places of al-Bīrūnī, we see that he wrote his famous book, *Āthār al-Bāqiyah* for Qābūs Washmagīr in Gorgan, "*Ma Li al-Hind*" in Ghaznah for Muḥmūd and "*Qānūn Mas'ūdī*" for Mas'ūd It only remains for us to say a few words about Gorgan or Jorgan or Gonabad in Estrabad around the Caspian shore To begin with, we should not mistake this Gorgan with Gorganej of Khwārizm, as the latter is still in Iran and has always been an important agricultural and cultural center in the north of Iran At the epoch of al-Bīrūnī, Gorgan enjoyed an exceptional period of peace, prosperity and culture Qābūs Washmagīr is noted for his patronage of arts, literature and science To his court flocked many important figures of the age Abū 'Alī Sīnā and al-Bīrūnī are the two most important personalities It is quite possible that the well-known dialogue between these two took place in the presence of Qābūs and in his court in Gorgan Anyhow, Gorgan is situated in a fertile plain through which runs a small river and all around live Turkeman tribes Gorgan was a haven for oustanding and freedom-loving philosophers, writers and scientists We know that Abū 'Alī Sīnā escaped to Gorgan rather than submit to Sulṭān Maḥmūd's wish Al-Bīrūnī had two sojourns there Once from 366 to 371 Hij and the second time from 388 to 403 Hij On both occasions, he was received and well-entertained

by Qābūs Washmagīr Thus, we may note at the conclusion of this small essay that the most important geographical places connected with the life of al-Bīrūnī are Khwārizm, Gorgan and Ghaznah Besides these towns, he travelled extensively in Afghanistan, visiting Kabul, Herat, Bamian, Gamdo-mak, Dinward and Balkh and participated in the expeditions of Maḥmūd in India There, he stayed in Peshawar, Sialkot, Lahore, Tilla, Jailum, Nandana where he came in contact with the Indian savants and learned Sanskrit and benefited from their knowledge and experience He never cherished any bias or prejudice He was lenient in his behaviour, tolerant towards opponents and ever ready to learn from the others and that is why we have gathered here to celebrate his millenary and his memories He belongs to humanity and is a great servant to the cause of progress and world culture

THE "KITĀB AL-ṢAYDANAH": STRUCTURE AND APPROACH

KAMAL MUHAMMAD HABIB

I—Introductory

AL-BĪRŪNĪ, on any count, would be considered to be a remarkable man There are very few people who are his equal in quest for knowledge He was a diplomat, a courtier, a negotiator, a mathematician, the first ever Muslim exponent of the Hindu philosophy, and, in the bargain, very knowledgeable about herbal and animal drugs, in sum, a most amazing polymath

Evaluation of the *Kitāb al-Ṣaydanah* today, after the lapse of nearly a millenium, becomes all the more difficult, because we tend to live today in a world of specialization Al-Bīrūnī's approach seems to be rather somewhat patterned on Thābit ibn Qurrah's *Al-Dhakīrah fi Ibn al-Ṭibb* and Abū Ḥanīfah's *Kitāb al Nibāt* characterized by eclecticism, excursion into the world of literature and collection of facts as well as folklore It is definitely a departure from al-Kindī or Al-Samarqandī's approach in that the formulation of ingredients have been but rarely described It also cannot be called a specialized work, because the author has tried to jam all kinds of information within the compass of about 400 pages Also the theoretical aspect which characterizes the writings of Ibn Sīnā is almost entirely absent in *al Ṣaydanah*, and the discussion sometimes is only etymological without any attempt at the discussion of the properties of herbals The dosages in which the substitutes for the drug under discussion are given have been described in certain cases but no indication whatsoever is available as to how a simple is to be incorporated in a compound drug Nor are compact definitions of electuaries, confections, stomachics lohocs, suppositories or pessaries forthcoming Like all the latter-day Muslim writers, al-Bīrūnī draws considerably upon the *Kitāb al-Nibāt* of Abū Ḥanīfah al-Dīnawarī, which fortunately has been edited since by B Lewin [from *alif* (الف) to *za'* (ز) only] Comparative work on al-Bīrūnī's *Kitāb al Ṣaydanah* and other materia medica like Ibn Bayṭār's is still indicated to assess the different approaches adopted by the Muslim writers of *materia medica* during the pre-medieval period, for which this author has drawn up a plan of research embodying translation, annotation, and a detailed discussion of the taxonomic aspects of natural drugs

Martin Levey, in his introduction to the *Medical Formulary of Al-Kindī* (The University of Wisconsin Press, USA, 1966, pp 1—8) classifies the types of works in the field of pharmacology as follows

1 Synonymic lists of *materia medica* in alphabetical order
2 Books on poisons
3 Medical formularies
4 Extensive lists of *materia medica*, mainly alphabetical generally including therapeutic considerations and views of other writers on the same subject
5 Tabular, synoptic treatises

Al-Bīrūnī, as far as possible, has tried to adhere to the alphabetical order The synonyms that he usually provides against each drug are usually Greek, Syriac, Persian, Sigzī (Sogdian), Zābulī, Sindhī, Hindi and Khwārizmian, and Tirmidhī in some cases The work also corresponds to type 4 in the sense that he has not spared quotations from past authorities on the subject, but does not in any way conform to types 2, 3 and 5 Another complexity that arises is that rarely does he quote the work from which he cites, and we have in the majority to be content with the author's name only

II —The Approach

It is yet to be sufficiently appreciated what a mine of information is *al-Ṣaydanah* in terms of the etymological discussion about the drugs' names as well as in providing synonyms Al-Bīrūnī himself emphasizes this aspect in introductory section of the *al-Ṣaydanah*

> One great difficulty about Arabic is that many of its words are similar and one has to differentiate one from the other by means of inflections and dots The slightest of negligence in this behalf will bring about obscurity and confusion, and, if the rectification is either sloppy or imperfect, the very existence of a work becomes meaningless One cannot then decipher what was meant and this kind of negligence unfortunately has become all too common a characteristic among us Were this not so, the works left by the Greek masters—Dioscorides, Galen, Paulos and Oribasius, which have been rendered into Arabic—would have sufficed But unfortunately we cannot depend upon them; and moreover, since rectifications and amendations have been introduced in the texts of their works, we cannot extract full benefit from them
>
> The translators of these works have done one great disservice to us. They have left out the names of some of the drugs which are

found in our region and which carry the same names in Arabic and Greek, although having translated the text, the translator would not have had to explain and comment For example, they have totally left out wild celery, wild carrot, barberry, mushroom of Malta, &c In a like manner they have omitted the names of *Al-Mudkhal, Al-Māqūlāt, Ibārāt, Qiyās,* and *Burhān*—the books on logic—from mention Our enemies therefore seek justification in ridiculing us for our lapses These days a book, called ***Dih Nām*** (Ten Names) I see in the hands of the people In the first place, it has been wrongly indited and almost useless, in the second, its text belies its name, for against each herb one does not find the ten names or equivalents

> The Christians have a book, ***Yashāq Samāhī***, meaning the exposition of names It is also known as *Chahār Nām* (Four Names)—that is, the Greek, Syriac, Arabic, and Persian synonyms or equivalents, of each herb are given I saw a manuscript of this work in Syriac, and found nothing in it that reflected misreading and omission, and I therefore copied several parts from the work

> I fully remember that a noble of Khwārizm fell sick A prescription was sent to him from Nishāpūr and given to the apothecaries One of the ingredients was unintelligible to the apothecaries till one apothecary claimed that he not only knew the drug but had it The noble paid the apothecary 500 *dirhams* for it The latter purchased the drug from the market for fifteen *dirhams* and handed it over to the noble Thereat the people around began to remonstrate with him The apothecary said 'I have only purveyed what you wanted, namely, sweetwood only you cannot show me its matter

Al-Bīrūnī wrote the work almost at ebb-time of his life and therefore there are many repetitions and omissions Aloes, for instance, has been discussed in detail under the name of *Siyāh dāwarān*, but also as *sāa* and *sibr* The *radīf dīd* has been repeated in the appendix to the main manuscript, and the author's adverse experience with asafoetida as a vesicant has been repeated many a time, undoubtedly through lapse of memory

Martin Levey says about synonyms

> The synonymic lists of Arabic *materia medica* are of interest because they provide equivalent terms and related words—in Greek, Old Spanish, Berber, Hindi, and other languages One of the better known lists in this category is that written by Maimonides (b 1135) (*Al-Kindī*, P 8)

But, if Moses Maimonides work written some 200 years after al-Bīrūnī, covers 408 well known drugs, then the wealth of synonyms provided by

Al-Ṣaydanah is far greater Our author's list of the drugs in the chapter on *alif* alone runs to some 138, and the coverage by al-Bīrūnī is therefore at least ten times as broad in scope Both, as it happened, were philosophers and both concentrated a great deal on the etymology of the drugs' names It seems that, after the decline of Islam in the East, the mantle of renascence was taken over by the Spanish Arabs and the greatest exponent of the Greco-Arab *materia medica*, Ibn Bayṭār, was a Hispano-Arab

It would perhaps be just as well if we could compare the approaches of al-Biruni and Maimonides The latter, for instance, says about *rātinaj* (pine resin) as follows in *Sharh Asmā' al-Uqqār* (No 352)

> It is also called *ratina* This the resin which the people of the Maghrib (Berbers), call *rajīnah* and the people of Egypt *qulfūniyā* It is also called *Zaft al-ghadhāwā*—It is the resin of the male pine (*al-ṣanawbar al-dhakar*) of the dry terebinth (*al-darw al-yābis*) On the contrary, the resin called (Koλo ϕ wvι α) in ancient Greece is the resin of the small pine (tannūb and not *al-qulfūniyā*)

To quote just from a cross example, al-Bīrūnī on the other hand, proceeds about *ādharbuyih* (which is also known as *ādharbū* and today as *Cyclamen europaeum* or sow-bread) as follows

> Called *tālūn* and *aṭrūkiyā* in Roman (i e , Greek), its root is known as *liṭfūras* and *liṭfūrin* In Syriac it is known as *artānīthā* and its root as *dawā-i-artānīthā* Among the pharmacists it is held that its Persian equivalent is *balāl* and it is known also as *qatād* Called *qalīm shū* too, since it cleanses wool, it is used as beard wash by the older people Abū al-Khayr in his gloss to the Kinnāsh of Paulos Aegineta says that it is saffron root I should presume that he has inferred wrongly

In so far as the Greek (which al-Bīrūnī rather interestingly calls Roman, undoubtedly because the Muslim world of the East was better acquainted with the Byzantinian Empire which included Greece) synonyms are concerned-he has had to depend upon Hunayn bin Isḥāq, Ibn Māsawayh, Māsarjawayh, Abū al-Khayr and others, with the result that he sometimes got them second or third hand An interesting transcription, for instance, is that of Cato the Censor who is spoken of as Qāṭājānis Similarly, Gaius Plinius Secundus or Pliny the Elder (23-79) is Aflīmūn in the text *Thalictrum spp* surfaces as *thāqaṭrūn*, and so on

The approach therefore of al-Bīrūnī is to give, first of all, as many synonyms as possible with regard to a plant or animal drug and then to attempt to describe it At times, however, he himself does not know a drug, but, all

the same, quotes different statements and then gives his own opinion He would like to assimilate as much knowledge as he can without fully digesting it For example, he describes ambrosia, or nectar, as *ambrūsiyā* It is obviously not a plant of the family Ambrosiaceae, as this is a North American genus What he obviously means is a polypharmaceutical but what he has actually described is a herb I shall content myself by quoting two instances

About *hūm al-maiūs*, which in all probability is the haoma plant or *Ephedra pachyclada* Boiss, al-Bīrūnī says

> In Saghdi it is *khūm*, *'arzād maghūshī* in Syriac, and *āftāb parast* and *hūyaghun* in Persian

> The Magians state as follows (about the plant) "It is a trunkless tree that grows in Adharbijan at a place which none can reach The snakes there used to eat the fledglings of two birds An angel brought at last a *hūm* bough and placed it in the nest of the birds The snakes' threat grew timorous and their fangs were closed The bough, however, took root and is still there That which is present there today is the self-same bough

All the species of *Ephedra spp* are medicinally important, but al-Bīrūnī, in any case, wanted to pack as much information on both hearsay and first-hand knowledge and what he has quoted is probably a distorted version of some Sāssānid legend which he heard from someone who himself probably got it tenth-hand

Another rather interesting and equally amusing account he gives is with regard to an alexipharmic drug, called *tiryāq-i-harawī* He states (*radif tā'*, No 5)

> According to Turunjī, it is a herb found in Herat Its leaves are like those of lily and its seeds like those of white lily It possesses a pleasant odour, and its bulbs are obtained in the same way as those of the iris It is a theriac for snake bite

> Turunjī narrates the belief held by the people of Herat to the effect that, if by means of a milky herb which in common parlance is known as theriac, ten worms are caught and placed in a luted vessel such that they eat each other up and only one worm survives, the surviving worm shall act as an instantaneously fatal poison

> Another person has stated that in Kāshghar or Balāsagūn occurs a herb known as *garā'ūt*, meaning black grass If this 'grass' is cut by means of a knife and is not washed but is instead used for inflicting a cut on a female goat, it acts as an instantaneous poison

Now from what possibly appears to be monocotyledonous plant, al-Bīrūnī has moved swiftly, to a possibly euphorbaceous plant, thence to worms and later to a herb that is known as black grass The intention is not to be discursive, but to feed as much information, rational or irrational, to the reader, with his own mind moving very fast

We must also not forget that, while in our time, the Linnaean system serves as a standard, in al-Bīrūnī's time no such system existed One word, for instance, can denote two entirely different plants *Shaybah*, for instance, means wormwood or *Artemisia absinthium* L (family Compositae), but it could also denote *Alectoria usneoides* Ach or *Parmelia perlata* Ach (tree-moss, family, Parmeliaceae) So, if al-Bīrūnī gives an account of *shaybah* in such a way that it is impossible to determine whether it is the composite plant or tree-moss that is implied, this is because he had to correlate the various descriptions of the herb As it is, while the external appearance described by him could correspond to the tree-moss, the medicinal properties are those of absinthium

He says, for example, that the plant presents the appearance of a plant whose leaves appear to have been trimmed by means of secateurs and also that it occurs as a cultivated variety and as an escape The second statement nullifies the effect of the first The appearance is that of a lichen and the properties correspond to those of absinthium

III —The Value of al-Ṣaydanah's Synonyms Today

As I have already pointed out, we should not forget that al-Bīrūnī was a product of the pre-Medieval Age The Muslim factor had reached the Trans-Oxus region barely two centuries before al-Bīrūnī's birth almost contemporaneously with its arrival in Sind, through two outstanding generals, Quṭaybah bin Muslim in Central Asia and Muḥammad bin Qāsim in Sind

In probability an Uzbek hailing from Khwārizm or modern Khiva in the Uzbek S S R who was both Arabic and Persian by culture, al-Bīrūnī perhaps knew many dialects as is attested by the synonyms he gives Syriac synonyms he probably bases on the work he has already referred to, the *Chahār Nām* or *Yashāq Samāhī*, while the Zābulī dialect he must have picked up in Afghanistan The Sigzī names should be particularly important, both etymologically and historically, as this dialect is now lost Similarly it would be interesting to study the Sindhi synonyms of the herbs and to see whether they have undergone any modification today

To quote one instance, he gives the equivalent of the herb, *jintiyānā* or chiretta as *nāgar mūthā* Today, of course, *nāgar mūthā* denotes cyperus, but as chiretta belongs to the family, Gentianaceae, one wonders whether al-Bīrūnī

has mis-interpreted the name or whether the Hindi synonym has undergone a change

There are also occasions on which al-Bīrūnī, despite the shadow of old age, failing sight and hearing and constant dependence on his amanuensis, Abū Ḥāmid Aḥmad ibn Nihishī can be surprisingly incisive I shall cite a few instances of his remarkable etymological accuracy to show how his work can still serve as guide today

Under *sha'ar al-jiyād* (the hair of the giant) and *sha'ar al-ghūl* (the hair of the ghoul) he has described two ferns as follows

39 *Sha'ar al-jiyād* —It is *asparsiyāwushān* which is *apariyāwush* It is also called *sha'ar al-jinn*, *lihyat al-himār*, and *kuzbart alba'yr* It would be described shortly *Sha'ar al-himār* is in fact, an apocopation of *sha'ar al-jabār*

40 *Sha ar al-ghūl* — It is *tarīkhūmānas* in Greek This is the correct conclusion It is *not* the maiden-hair, as many would have so believe Some call it *adyanālūn* which is the maiden-hair It grows alongside the maiden-hair It is rather like the herb *ṭāras* which is *sarakhas* Its foliage is long and equilateral, slender like the lentil, facing each other, on slender boughs that are inclined to be blackish and lustrous People believe that its actions are analogous to those of the maiden-hair

Sha'ar al-jabār is known as *parsiyāwushān* in Persian today and is in all probability *Adianatum capillus-veneris* L or some other species of the same genus (family, Pteridaceae) On the hand, *sha'ar al-ghūl* would be *Trichomanes* syn *Onychium japonicum* Thunb also a fern The description of the latter corresponds to the sporophylls of ferns characterized by circinate vernation and pinnules (as in maidenhair) The transcription of the Greek synonym thus provides the key to the identification of the plant

As for the discussion of the therapeutic properties of drugs in *Al-Ṣaydanah* it is extremely uneven, but surprisingly enough, is rather detailed in the Appendix to the manuscript In the Appendix the *radifs shā'* and *ḍād* are described Often the description of herbs is intercalated with verses from Arabic literature to establish a point but on many occasions occur just as a piece of literary exercise, and entirely irrelevant at times But there are occasions on which verses are quoted to establish a rather cogent point as in his detailed discussion of *utrujj* which is *Citrus medica* Risso *var* cederata (citron in English), or to show how harbours and cities have been closely associated with herbs and perfumes, as in his detailed exposition of the word, *Dārīn* Al-Bīrūnī has also provided certain important clues regarding the synonyms for herbs

Ḥabb al-ẓalim, for example, is a name that is ascribed to the hemp-leaved hibiscus or *Hibiscus canadensis* L (family, Malvaceae), to artichoke seeds, and to *Habelia aethiopica* The last is the *habb al-ẓalim* of Serapion or monkey pepper But al-Bīrūnī has to say as follows about *ẓalim*

> "I assert that the tree is *salammah* in Syriac and *kirāsūs* in Greek The plant occurs abundantly in Ṭā'if, as also in the mountains of Yaman, north of Mosul, and the mountains of Jūdī In some cities some people designate it as *qarāsiyāh*, while others give it the name of *karz* The people of Arabia make from it cups, arrows, and small items of daily usage Its timber is reddish, powerful, solid, and strong The foliage resembles that of the apricot tree, while the fruit is like jujube, suspended by means of a green thread in pairs The colour of the fruit, to commence with, is red, but becomes dark bay later on Some varieties are black, some are sweet, and some sour It comprises a large number of kinds—some sweet, some sour and some tasteless These are the varieties by virtue of taste, but from the standpoint of the other characteristics, the position is that some threads are long and others short Some are dark bay, some red or cornelian Every variety is astringent, but every variety carries an identical degree of astringency In fact, the degree of astringency is determined by differences in taste, as is well known "

It is perhaps obvious that al-Bīrūnī is referring to a woody and not a herbaceous tree, and the tree implied is *Prunus cerasus* L (family, Rosaceae) known as *ālūbālū* in the Sub-Continent It is characterized by astringency and its bark is bitter, astringent, and febrifuge What has been transliterated as *kirāsūs* is obviously the Arabic transcription of the same word, being derived from the word, *keras*, meaning horn in Greek A very allied species is, of course, the bird cherry or *Cerasus cornuta* Wall ex Royle so that, though today *habb al-ẓalim* or *ẓalim* may denote more than one plant, there was no doubt in al-Bīrūnī's mind as to what it was

Another very sharp instance of al-Bīrūnī's acumen is demonstrated by his description of *'āqir qarhā* or *'āqīr qarhā*, the Roman or Spanish pellitory root, with its original habitat in North Africa This is what al-Bīrūnī has to say about it

> "It is a name applied to the root of the *ṭarkhūn-i-Rūmī*, while some believe it to be the root of the Persian *ṭarkhūn* In the mountains of Bāmīyān occurs a tarragon variety with large foliage Its roots are thick—thicker than those of the pellitory and possess the same kind of pungency "

Damishqī says *Baglah al-'āqir qarhā* is *ṭarkhūn*, while in the *Kitāb al-Ṣaydanah* it has been stated that the best variety is that which is pungent and singes the tongue It is an inch thick and, on plucking,should reveal a red interior

Galen in the *Miyāmīr* writes Its Greek name is derived from "fire" Dioscorides says that on *fūrthārn* there is a hairy umbel in the manner of the fennel Its roots are an inch wide and bite the tongue

Unfortunately *'āqīr qarhā* has been too facilely taken to be the Spanish or Roman pellitory or *Anacyclus pyrethrum* D C (family, Compositae) This is, however, by no means the case as we propose to show

The key to the whole point lies in the fact that, according to Dioscorides, the plant designated is one that possesses the appearance of an umbelliferous plant but has the properties of the pellitory This point has been discussed by Dymock, Warren, and Hooper in *Pharmacographia Indica* (Vol II, 233) in considerable detail, and they have invoked the aid of the *Makhzan al-Adwiyah* by Mīr Muḥammad Husayn, written some 700 years after al-Bīrūnī's work The mountainous variety known as *'ūd al-karīh jabalī* in Arabic and occurring commonly in Syria is an umbelliferous plant which is also called *ṭarkhūn*, and is the root of *Smyrnium cordifolium* Boiss (family, Umbelliferae) or the plant known as *Smyrnium officinarum*, Hayne, or German pellitory So that al-Bīrūnī has already shown through citation of different sources that there are two kinds of *'āqır qarhā* One is a composite plant and the other an umbelliferous plant, especially as he has quoted Dioscorides to the effect that it bears a fennel-like hairy umbel The Western variety of *'āqır qarhā* has been described by *Ibn Bayṭār* also In fact, al-Bīrūnī's description relates to the Western or German pellitory and not at all perhaps to *A pyrethrum* D C, which in the Greco-Arab *materia medica* is equated with the Spanish pellitory The name *'āqır qarhā*, itself is derived from *'āqar* and *taqrıh*, meaning to cause sore One author has already quoted Galen to show that its Greek name is derived from fire Both varieties are possibly antiscorbutic, cordial, and stimulant, and are given in rheumatism

It would also be obvious that the *ṭarkhūn* described by al-Bīrūnī is also not *Artemisia dracunculus* L (family, Compositae) but *Smyrnium cordifolium* Boiss, and it is therefore doubtful whether *ṭarkhūn* should therefore be accepted as A *dracunculus* L and not as the German or Western pellitory Levey and al-Khaledy (*The Medical Formulary of al-Samarqandī*, Philadelphia, University of Pennsylvania Press, 1967, p 202) quote from Maimonides to the effect that *ṭarkhūn* is the name of the leaves of *'āqır qarhā* But that it is not confirmed by the recent authors, who, on the contrary, say that it is a species of celery (karafs) *Karafs* is, of course, an umbelliferous plant and therefore what Maimonides has described is just a rehash of al-Bīrūnī's description This also provides us with a spoor *en regard* al-Bīrūnī's observation with respect to what may be defined as the phenomenon of repetition in nature, and is at very basis of induction There are many amusing slips like quotation of the Egyptian credo that the offspring of a crocodile that wends its way to the land becomes skink (*isqanqūr*), while the offspring moving riverwards takes after the

parents These and many other suppositions like a dragon describing arabesque designs on the *hajar al-yashf*, that is, jasper, are based probably on the Greek and Persian works tinged with a mythological coloration This legend appears to be of either Greek or Persian provenance, possibly the former, and a great majority of the minerals described by al-Bīrūnī fall into this type An example from a stone called the *hajar-i-Ghāghāṭīs* would serve

Hajar-i-Ghāghāṭīs—A light stone, which, according to Galen, on inflammation gives off the odour of the *qafr-i-Yahūd* This name has been given because the stone which Dioscorides and others describe was found in Idqiyah in the river Ghāghātīs These stones are soft and have asphalt sticking to them An apoplectic patient immediately falls down on inhaling their (smoke)

While the stone implied is indeterminable in face of the scant information provided, one can of course infer that what has been described is a variety of concretion It would be perhaps rather interesting to do some homework on the geographical names given by al-Bīrūnī For instance, what he denotes as Sufālah is not the East African port but is probably a corrupted transcription of Sangala in the Panjab, near the present-day Sanglawala Tiba or Sangla Hill It is the Sangla of Alexander, and was visited by the famous Chinese pilgrim-traveller, Huen Tsang in A D 630 and is associated with the well-known herb, *fāghirah*, or *Zanthoxyllum* spp (family, Rutaceae) Asia Minor figures rather prominently with usually intact transcriptions since Dioscorides and Galen hailed from Asia Minor, and Paulos Aegineta who was alive during the Muslim conquest of Egypt in A D 640, resided in Alexandria and had close associations with Asia Minor Moreover, the Muslims of al-Bīrūnī's time were closer to the Eastern Roman or Byzantinian Empire than to the Western arm of the Empire, the original Rome Rome therefore for al-Bīrūnī was Constantinople

However, sometimes the geographical locations given by al-Bīrūnī are rather complex as in the following description of *ṭabāsheer* or *Bambusa arundinaceae* syn *B Lambos*, Druce

> *Tabāshīr*—It is known in Hindu as *bayn-sharawchan* and *tūshīr* It is said to be Zangī A commodity that looks like wheat flour is brought from India and is called *lukur* It is claimed that this is *ṭabāshīr-i-Hindī* It is known as *qamhādarzā*, *ṭabaqshīr*, and *tawakshīr* Rāzī says that it is found inside bamboos in the manner of the incinerated bone Abū Mu'ādh calls it the ash of the bamboo root Zinjānī says "If you travel eastwards from Sandān in the direction of Matānā and later of Jaymūd, reaching the territory that faces the region of Jaybwān, finally arriving at Jindrāwar, you will have reached the place *ṭabāshīr* is fetched from"

Dymock, et al (*Pharmacographia Indica* Vol III, p 589) believes *ṭabāshīr* to have been derived from the Sanskrit *tvak-kshirā*, and also that the port of Thana in India was well known for the export of *ṭabāsheer* in the time of Idrīsī, some hundred years after al-Bīrūnī So that the description, it would see, relates to what we know as Maharashtra today Zang or Zanj is the modern Zanzibar, and this might point to the original home of *ṭabāsheer*

Al-Bīrūnī's description of *siyāh dāwarān* or the aloes follows very closely the traditional description current during his time about Socotra and the occurrence of the aloes there Owing to the fact that the book has probably been dictated, there is not only, as mentioned earlier, repetition, one drug surfacing under another name and with the *radīf rā'* entirely omitted, but the description is dovetailed, being at times telegraphic and at others downright vague Such is the case with his narration of the aloes

> *Siyāh dāwarān* —It is a synonym for terebinth Some claim it to be the oak In Syriac it is *maqir* and this would be, in fact, the aloes Abū 'Ubaydah writes From *maqir* come out the aloes, followed by lycium and sediment *Maqir* remains like a peg Select a variety that is clean, smooth, and not hard Its colour, a mixed yellow and black, should appeal to the eye in manner of the colour of the liver It should not be easily brittle Do not take the black variety that breaks after some time It is mixed with acacia and gum The one that does not break easily does not quickly dissolve in water

Here there are two possibilities Either the aloes as imported has been described or a metonymic—that is, lycium in the sense of juice—expression has been employed But the general impression that this quotation carries is that ophthalmic barberry comes out of the aloes While describing the aloes, al-Bīrūnī also refers to the Samanjānī variety This would be Sanjān or today's Sinkiang in China By and large, he is more at home while describing the geography of West Asia He is thus almost correct in saying that Socotra is a day's journey from Shahar by boat

One is surprised that despite the fact that several Greek names through the process of transliteration into Arabic have been completely changed, as Plato in Aflatun and Ptolemy in Batlimus, al-Bīrūnī has managed to keep the Arabic transcriptions or transliterations as close as possible to the originals As I have stated earlier, if the Greek word, *thalictron*, or *Thalictrum* spp surfaces as *thālqaṭrūn*, the fault is not al-Bīrūnī's since he is following the Arabic pattern for transliterations, with the Greek *theta* metamorphosed into *thā'* and the Greek *omicron* into *wāw* I have personally not been able to determine the modern botanical equivalent for the herb called *jinjidyūn*, which al-Bīrūnī calls a Greek herb, but there are occasions when there should be little

difficulty as in the herb *nifātūs*, whose Arabic equivalent he has not provided, but which should be *nepetos* or *Nepeta* spp, possibly *N. cataria* L (family, Labiatae) especially as the external characteristics described are those of a labiate plant The latter-day Muslim physicians like Mīr Muḥammad Husayn Khurāsānī call *Ocimum* spp *asmīm*, but al-Bīrūnī followed the Arabic technique and gives the Greek synonym for *bāzrūj* or the white basil as *uqimum* which should be closer to the ωkιμον of Dioscorides Likewise, the following description should also provide us with a clue to the herb described

> *Al-baqlah al-Fārsiyah* — Known also as *tarah dahān*, meaning the slave-girl's vegetable It is also known as *tarah qurbah*, that is, the cat's vegetable, as the cat falls in love with the herb, eats it, sits under its shade, and rolls on its leaves and boughs

The plant described is as little reflection would show, what is known in Punjabi as *billīlotan* It is *Nepeta ruderalis* syn *N hindostana* Hook (family, Labiatae), especially as this family is ecologically favoured in the temperate climate of Iran, hence the name

Another point which weighs immeasurably in al-Bīrūnī's favour is the wealth of synonyms which he has given from the Khwārizmian and other dialects of Irān and the Trans-Oxus region For instances, *buqqam* or the redwood tree has been given the Persian and Khwārizmian synonyms of *dār-i-parniyān* and *panjnak* respectively The Persian name obviously signifies "the painted China silk wood", while the Khwārizmian name signifies some other characteristic and the Arabic name could have been *fakam*, according to Ḥamzah Iṣfahānī, so that each people view a tree according to their understanding of its principal external or internal characteristic, as in the plant, *billīlotan* or *baqlah al-Fārsiyah* This applies to many other herbs and with the taxonomy of angiosperms coming under constant review, works like those of al-Bīrūnī and Ibn Bayṭār are of immeasurable value

IV — Al-Ṣaydanah and Modern Floral Systematics

The most monumental work on the flora of the subcontinent, Hooker's *Flora of British India* (1872-1906), unfortunately remains to be updated As R R Stewart has rightly emphasised (*An Annotated Catalogue of the Vascular Plants of West Pakistan and Kashmir*, December, 1972, p i) a vast amount of collecting has been done since Hooker's time, and, moreover, fringe areas like those of Swat, Chitral, Gilgit, and Hunza need to be added to the future flora The herbs of many of these areas would probably correspond to the herbs described in *al-Ṣaydanah* According to Stewart, K H Rechinger and his team would be compiling the flora of Iran and Afghanistan long before Pakistan and India, and parts have already been coming out since 1963 In Pakistan also monographs on the smaller families have already appeared and

number 30 to date Many herbs today are cultivated in the Sub-Continent but are of foreign provenance A very glaring example is that of the turnip A work like al-Bīrūnī's *al-Ṣaydanah* should provide us with a clue to the original habitat of the herb, synonyms therefor, and its therapeutic usage The last aspect has been taken care of by *Pharmacographia Indica* by William Dymock, C G H Warden, and David Hooper (1890-93) which needs drastic addition and revision, now that it has been re-issued by the Hamdard National Foundation For this the nation's thanks are due to the Foundation

Desirability for further work on natural drugs has been emphasized *ad lib*, and it is not my intention to discuss this point further But the point to be emphasized is that as a prelude to further work we must have at hand the equipment for identification and a standardized nomenclature is the best tool for the purpose Later on, it may be possible to fix the Urdu names in accordance with the Arabic/Persian synonyms that are closest to the Linnaean names and there is little doubt that *al-Ṣaydanah* should offer a good deal of assistance *apropos* of this work despite being discursive, at times thoroughly non-scientific, and at times generating uncontrollable resistibility

V—The Therapeutic Aspect of al-Ṣaydanah

There is a pattern discernible with regard to the discussion of the therapeutic properties of herbs in *al-Ṣaydanah* Under *radīfs bā'* and the appendix to the main text the information on medicinal properties is more detailed than in the other parts To take the instance of *balasān*, or the balm of Gilead, one of the most major Greco-Arab drugs, it is considered by the Arabs to be valuable in epilepsy and pain, an alexipharmic, and as warming agent for the liver and stomach, an ocular tonic, and also as useful in elephantiasis Let us now see what Al-Biruni has to say about its medicinal properties

> "*Balasān* is deobstruent and of benefit in visceral hardness and detergent for wounds, especially if given with orris oil, since it removes the sheaths of bones As a draught, it is recommended for sciatica Its decoction is taken in spasms It is indicated in wounds and as a cephalic detergent It is of utility in epilepsy and vertigo It cleanses the eye of opacity and is an ocular tonic Its wood and grains are emollient in uteralgia, asthma, and pulmonary pains Its grains are appropriate for the treatment of pneumonia and cough the same thing is true of its oil It is the drug of choice for the viscera that are situated above the hypochondrium, is a curative for digestion, a stomachic, and its decoction particularly acts as a carminative It is detersive for the stomach and a diuretic It is anti-colic and a desiccant for the uteral humours It aids (at the time of parturition) in the discharge of the foetus and the placental membrane As a fumigant, it is useful in all uteral affections It cures strangury A cerecloth of the herb, comprising its oil along with the rose oil

and wax, is useful for the coldness of the uterus and for strangury The oil is also useful in fevers accompanied by shivering A draught of the herb taken with oil, acts as an alexipharmic for hemlock, and would be beneficial in headaches in particular "

This catalogue of the medicinal usage of the balm of Gilead is more detailed than one would find in *Glossary of Indian Medicinal Plants* by Chopra, *et al* or in *Pharmacographia Indica* It has not been described as a curative for strangury and as a diuretic Similarly al-Bīrūnī's description of the method for testing the purity of the gum-resin exudate, while appearing rather primitive today, should no doubt have been a useful addition in his own time

Or take his description of *balādhur* or the marking nut Our author has to state this about the drug

> "It acts as a vesicant and corrodes the blood and the humours It excises the warts of the body It also removes the scars left by leprosy and tatooing It cures alopoecia but promotes the internal hot inflammations The famous *mā'jūn anqarūyah* is employed in the diseases due to paralysis, nerve paralysis, facial paralysis, and amnesia But it also stimulates phantasmagorial visions and melancholia Used as a fumigant, it dries up the haemorrhoids of the piles It is counted among the poisons and corrodes the humours Yogurt counteracts, to some extent, its alexipharmic properties and walnut oil destroys its power "

This description is slightly different from the one given about its usage in the Sub-Continent Here its nut is bruised and applied to *os uteri* to procure abortion and, as described by al-Bīrūnī, it is considered a vermifuge The oil from the nuts is used a vesicant, and is used externally in rheumatism and leprous nodules The gum from the bark is used in scrofulous, venereal, and leprous affections and in nervous debility The ashes of the plant, in combination with other drugs, is used in snake-bite and scorpion-sting It is obvious that here it is not used in the treatment of piles, but al-Bīrūnī has emphasized this aspect The same kind of description is given by Ibn Bayṭār later

Another aspect that deserves attention in al-Bīrūnī's work is his description of the substitutes or succedanea, for example, as the substitute for the marking nut Al-Bīrūnī—no doubt, basing his view on the past works—gives a combination of five times its weight of the hazel-nut, one-fourth its weight of balsam, and one-sixth by weight of egg oil as the substitute And al-Bīrūnī has been rather generous in the information on *abdāl* (substitutes)

His description of the orris root is also equally detailed

> " Orris is calorifacient, demulcent, lenitive, flatulent, deobstruent, detersive, purifier, and its juice, dissolved in honey, acts as a resolvent

for the phlegm, and dispels it A mouthful of its pulvis will remove freckles and spots, and will alone be sufficient Its decoction is beneficial in scirrhus, inflammation due to malhumours, ulcers and for the face It helps in the granulation of ulcers, even if sprayed, and promotes the growth of fresh and wholesome flesh on the bones It counteracts exhaustion Quaffed with wine or vinegar, it is a cure for eclampsia and weariness of the muscles A sudorific, it is also a palliative for chronic aches and pains It is taken as a draught with rose oil and vinegar in the treatment of pains and aches A sternutatory too, gargles with its decoction would act as an anodyne in toothaches Orris oil, when given with vinegar, overcomes reverberations and echoes in the ear, and is beneficial in the treatment of chronic cold and sinus, its oil and decoction would remove the foul odour of the nostrils, would be of use in wounds, would act as an epiphoric agent, would alleviate lumbago, and is especially recommended in coughs due to malhumours, pneumonia, dyspnoea, and cynache It is an attenuant for the egesta that have accumulated in the chest and are resolved by it It is drunk with concentrated must in pectoral ailments Gargles of the herb in conjunction with concentrated must are beneficial for the throat, stomach aches and cold spleen, especially if taken with vinegar it is especially advantageous for the spleen It is salutary for hydrops, whether applied externally or internally It also removes the haemorrhoids and cures gripes, controls excessive flow from the prostrate gland and regulates ejaculation Given with wine, it acts as an emmenagogue Women desirous of curing uteralgia sit in a bath containing its decoction An old herb bruised and mixed with honey would facilitate the removal of the bile, cholers, and phlegm, the measure of the wine ranges from one *awqiyah* (that is, 16 9/g) to several *dirhams* (one dirham — 3 125/g) Its oil cures fevers and the fevers that are accompanied by tremors The herb is an alexipharmic, and possesses innumerable other advantages '

The herb described obviously corresponds to the root of *Iris florentina* L (family Iridaceae) which is used today in Egypt as a detersive and emmenagogue and in liniments This is undoubtedly one of the most detailed narrations of the therapeutic characteristics of the herb in the Greco-Arab *materia medica* Of course, the uses of the root are many and so variegated that it amounts to being almost a panacea, but even then al-Bīrūnī's account of its medicinal properties would be outstanding in its comprehensiveness

It would be interesting to study the sources quoted by al-Bīrūnī The most prominent is, of course, Dioscorides (Galen having concentrated more on the medical than herbal aspect), followed by Abū Hanīfah, Rāzī, Ibn Māsawayh, Ḥunayn bin Isḥāq, Ḥamzah Isfahānī, Abū al-Khayr (as a commentator

on the work of Paulos Aegmeta), Abū Mu'ādh, Paulos Aegmeta, and others Theophrastus, Pliny, Serapion and Aetios of Amida are but rarely mentioned Ibn Sinā has not been quoted at all—probably because their relationship was not good or because al-Bīrūnī did not obtain his *Kitāb Muntakhib Shifā al-ṭib*, *Kitāb al-Sa'ādah wal-Iqbāl*, and the Canon The intactness of the Greek names, in a larger measure, in *Al-Ṣaydanah* is perhaps due to the fact that Iṣṭafan Ibn Baṣīl, a Syriac Christian who lived during the reign of the Caliph al-Mutawakkil (847-60), had already translated Dioscorides' *Pedani Dioscorides Anazarbei de Materia Medica Libri Quinque* into Arabic without resorting to a Syriac intermediate His teacher, the celebrated Ḥunayn Ibn Isḥāq, later on improved and almost re-wrote it Ibn Bayṭār who succeeded al-Bīrūnī after two hundred years also cites in *Jāmi' mufradāt Al-Adwiyah Al-Aqhdhiyah* almost the same sources, with a few more like those of Isḥāq bin Sulayman al-Isrā'īlī of Qayrawān and al-Bīrūnī himself

Al-Bīrūnī's attempt has undoubtedly resulted in a compendium, but none the less, represents a great attempt at synthesis It would have been more effective and valuable if it were compiled in a synoptic, tabular form, as is the case with the *Kitāb al-Musta'īnī* by Ibn Biklārish al-Isrā'īlī of Saragossa (fl 1106), each of its leaf being divided into five columns, each column giving the name of the herb, its Galenic nature and grade, synonyms in Persian, Syriac, Greek, Latin, and Spanish, the substitute drug, and finally the preparation and the therapeutic value and uses of each drug The very fact, however, that Ibn Bayṭār quotes from al-Bīrūnī's *Kitāb al-Ṣaydanah* shows that the book was already regarded as a comprehensive reference work, the culminating point of which was Ibn Biklārish's work

NOTES ON AL-BĪRŪNĪ'S VIEWS OF AL-RĀZĪ'S WORKS

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AL-BĪRŪNĪ Abū al-Raiḥān Muḥammad b Aḥmad (362-443 H —973-ca 1051 A D) left to succeeding generations an Index of al-Rāzī's (Rhazes, A D 865-925) works *FI KUTUB A BAKR B ZAKARIYĀ AL-RĀZĪ* The excellent edition by Paul Kraus in 1936, was consulted for this research No comprehensive evaluation has been made of al-Bīrūnī's Index beside the German translation and annotations by J Ruska which have many shortcomings In this paper, however, an attempt will be made to evaluate al-Bīrūnī's appreciation as well as his criticism of al-Rāzī and to consider al-Bīrūnī's objectivity, scholarship, and interest in the history of science and literature

At the beginning of his thesis, al-Bīrūnī refers to Isḥāq b Ḥunayn's (junior contemporary of al-Rāzī) biographical sketches and classification of physicians and sages, (Greeks and Arabic authors) up to his time Isḥāq b Hunayn, as we previously mentioned flourished shortly before al-Rāzī's time It was implied that al-Bīrūnī is carrying on where Isḥāq has left as far as the biography of al-Rāzī is concerned Indeed, al-Bīrūnī has not undertaken the writing of al-Rāzī's bibliography from his own initiative On the contrary he tried to get away from such a responsibility, when he was asked by a dear friend of his He even apologized once and twice for not doing so pretending incompetence in this area, the lack of time, and adequate information, as he reports in the introduction to the present Index But his friend persisted in his request, and al-Bīrūnī finally consented complying to his friend's wish He writes — "I have listed for you the books of Abū Zakarīyā' which I saw or acquired Had it not been for my profound respect to you, I would not have done so I am afraid such an undertaking would bring upon me the hatred of his (Rāzī's) opponents as they might think of me as one of his followers who approved his ideas"

Indeed al-Bīrūnī was very apprehensive of the awkward position into which he had been pushed He was under the impression that al-Rāzī was a heretic and unorthodox in his beliefs He states "al-Rāzī has led astray his readers into believing the books of Mānī and followers of that faith which are

not in harmony with Islam's religion and tenets " Al-Bīrūnī adds "The proof of my words can be proven when al-Rāzī's book on prophecies and the prophets is compared and analyzed It is an outright attack on our religious faith " Unfortunately, these writings are lost since, and we have no way of checking them against al-Bīrūnī's assessment Two aspects, however, need to be emphasized

One, is the fact that there were many writings which were attributed to al-Rāzī by later authors bearing his name but were spurious It seems strange that al-Bīrūnī has not entertained any doubts regarding their authenticity

Two, in supposing that such writings were Rāzī's, why al-Bīrūnī who respected and devoted his intellectual life to freedom of thought denies al-Rāzī his right to express his beliefs?

Al-Bīrūnī wrote this Index in 427 H 1032 A D , after he corresponded with Ibn Sīnā' Within this contact, Ibn Sīnā' criticised al-Rāzī and his theories, and pointed that a man devoted to medicine should not turn to dabble with philosophical and metaphysical matters which he is not qualified to tackle Al-Bīrūnī agreed with this line of thinking, and joined in the attack against their predecessor They considered such an attitude by al-Rāzī as unseemly interference in what he does not understand Such writings they thought, should have been left to the competent philosophers and logicians

The attitude towards al-Rāzī, a great physician and thinker as he was, seems very unfair to us today Indeed over seven centuries ago the physician-historian, Ibn Abī Uṣaybo'ah [A D 1203-71] expressed a similar opinion He felt that the criticisms were harsh and unjustified to say the least He writes "Al-Rāzī was intelligent and kind to his patients He was industrious in his work, to offer the best possible treatment for his patients He was persistent in his attempts to disclose the mysteries of the healing art, and to discover new facts about its applications He excelled in the natural sciences in which he contributed greatly " In the views of this writer, al-Bīrūnī seems to have been led by jealousy and possibly bigotry influenced by public opinion, to take such an attitude against the great clinician and thinker, al-Rāzī

Interestingly, al-Bīrūnī tells us how he gathered his information on al-Rāzī's books or at least on a number of them It was through al-Bīrūnī's interest, early in life, in collecting books on alchemy He was, for example profoundly interested in acquiring Rāzī's most famous book on alchemy, entitled *The Secret of Secrets* He explains, "The mail from Hamadan brought me, while I am in Khwārizm, among other things, the book, *The Secret of Secrets* I was filled with joy when I obtained it It was like a thirsty person who sees reflections denoting water, but this feeling turned into unhappiness when he discovers that it was a mirage " God spoke the truth as recorded in the Holy Qur'ān, al-Bīrūnī quotes, "Any one who does not seek God for light on (his path) has no light in him (stays in darkness)".

At the end of his treatise, however, al-Bīrūnī gradually became more charitable in his judgment of al-Rāzī In reality he concludes his evaluation of al-Rāzī by suppoiting him He reiterates "And I don't believe that he is trying to deceive others, but he himself was deceived"

Then al-Bīrūnī wrote in his thesis about the birth of al-Rāzī, his good works, and his preoccupation with chemistry He adds "Abū Zakarīyā' has promoted the medical profession to a high degree and was needed and called upon by kings and they received him with great respect"

Al-Bīrūnī describes for us the method of al-Rāzī in his study and research He says "He (al-Rāzī) studied diligently and continuously, putting his lamp attached to a small holder on a wall opposite him He held the book against him, so that if he became sleepy the book would fall down from his hand and awaken him"

After mentioning the date of al-Rāzī's death in al-Rayy, 315/925, al-Bīrūnī lists the books of al-Rāzī as he knew them He divides them (according to P Kraus edition) into the following classification of books, and short or long letters

1	Medicine	56
2	Natural sciences	33
3	Logic	7
4	Mathematics and astrology	10
5	Interpretations, summaries, and resumes	7
6	Philosophical and augury	16
7	Metaphysical	6
8	Theological	14
9	Chemical	21
10	Atheistic works	2
11	Various arts	10

The total number is therefore 103, on all the abovementioned fields of knowledge

At the closing section of this Index of Rāzī s books, al-Bīrūnī elaborated on the works which he himself has written and those he was engaged in writing them For example he mentions his book on astronomy with tables *zīj al-Khwārizmī*, the reply to Ibn al-Hasan al-Ahwāzī, and the mediation between him and al-Khwārizmī Al-Bīrūnī adds that when he was in the land of Sind-Hind (present India and Pakistan) he completed a book entitled, "*Jawāmī al-Wujūd li khawāṭir al-Hunūd min Hisāb al-Tanjīm*" in 550 folios

At the end of the letter [risalah] however, we see al-Bīrūnī complaining to his friend about his ill health He says, "I am beset with many illnesses which have affected my body and made it weak to move They spoiled the faculties thereof " He hereafter exclaimed, "My bodily strength is enfeebled by old age" Yet inspite of his bad health we find his program for future works is greater and more ambitious than ever He writes, "I am now to concentrate on one thing at a time and avoid shortcoming in writing it" The model for his achievement is to be like or surpass his great book on astronomy, *al-Qānūn al Mas'udi* which he dedicated to his patron Mas'ūd, and *al-Āthār al-Baqiyah 'an al-Qurūn al Khāliyah* He then enumerates ten of his major books Finally al-Bīrūnī affectionately speaks of his literary contributions He says, "they are all my children" In so stating, he did not exclude any of them, not even those which he wrote in his youth He continues, "And what others have written under my name, to me they are like babies in the lap, and necklaces on the neck, they too are my children I don't differentiate between them and my own sons"

The total number of the works of al-Bīrūnī (his children as he called them), given in the book of *al-Fihrist* by Muḥammad Ibn Isḥāq al-Nadīm (d A D 995), is about 180 books, small and large One can easily see a source of pride and a feeling of self esteem and satisfaction that he felt Not least among them is his Index of al-Rāzī's works

In the edition which was published in Cairo 1956, by D J Boilot, these 180 books are listed in the order of their classification in alphabetical order and again include the epistle on the books of al-Rāzī, the one concerning us most in this study

We noted above that al-Bīrūnī sees that al-Rāzī was himself deceived and never intended to delude his readers This was clarified and confirmed by Ibn Abi Uṣaybo'ah (d 1271) in his *'uyūn al-Ānbā'* In enumerating the books of al-Rāzī, ***Kutub Abū Zakarīyā'***, he emphasized very strongly the possibility of spurious publications carrying Rāzī's name Uṣaybo'ah writes, "probably some wicked opponents of al-Rāzī have written some books and pretended that it was he who wrote them This they did in order to do him harm by ascribing suspicious writing to him"

In my judgment, al-Rāzī is too honorable and sensible and no such books can come out of his pen This writer feels much in favor of this intelligent proposal

Al-Bīrūnī did not confine his criticism of al-Rāzī to philosophical and sectarian matters but also, and rightly so, in geometrical and mathematical matters involving the division of a curved line and other related problems

In the foregoing brief discussion, it was clearly indicated how misrepresentation spoils intellectual judgment, that al-Bīrūnī showed not only professional "jealousy", but misunderstanding and biased attitude toward al-Rāzī, a man who contributed so much to Arabic medicine and human knowledge. Another great genius, who himself was not understood in his generation, was the one who expressed such contempt It is one of life's ironies, that such two outstanding figures, apart by over one century in time, failed to appreciate their real intellectual place towards each other Was it that al-Bīrūnī feared to express favourable inclination to the man of Rayy, lest he found himself amidst socio-political problems of which he had enough, we are not sure There are indications in this epistle that once in a while al-Bīrūnī realized Rāzī's greatness, but he concealed such admiration It was clear that al-Bīrūnī attempted to steer away from anything to do with al-Rāzī We believe he showed moral weakness in this matter But neither the criticism nor his avoidance of al-Rāzī will minimize the great accomplishment each of the two men contributed to human knowledge and scholarship

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AL-BĪRŪNĪ, THE FATHER OF ARABIC PHARMACY AND MARINE BIOLOGY AS DEMONSTRATED IN AL-ṢAYDANAH

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FROM a careful study of extant copies of *Kitāb al-Ṣaydanah fi al-Ṭibb* (meaning literally, pharmacy in the healing art), by Abū al-Raiḥān Muḥ b (for Ibn) Ali al-Bīrūnī al-Khwārizmī (973-1051), it seemed appropriate to call its author, "The Father of Arabic Pharmacy and Marine Biology' He evidently established definitions, professional objectives, and basic experimental procedures in these two and other related fields as no one else did before him in medieval Islam He presented meticulous and detailed descriptions of the materia medica from plant origin, from minerals, as well as from animals both on land and in the sea, giving synonyms in several languages [1]

Original Copies of al-Ṣaydanah

Al-Bīrūnī's book on pharmacy and materia medica, *al-Ṣaydanah*, came down to us through a first draft (*miswaddah*) which was dictated by the author who added marginal notes and data collected from earlier medical compendiums about 1051, very shortly before his death at the age of 78 He was assisted in this great task as well as in writing the text, by the learned scholar, al-Shaykh Abū Hamid Aḥ b Muḥ al-Nahsha'ī (of Ghaznah) Of their original rough draft, the following copies in Arabic are known

One is the Baghdad Copy No 48, housed at the Baghdad University Library, written in elegant and very legible vowelized Naskh script, in 425 vols, 17 × 24-1/2 cm, 19 lines pp This somewhat later copy seems to be the best organized and readable, and the most complete among extant manuscripts of this work The Arabist scholar Fritz Krenkow had made a copy of it reported by him in a note written at the end of the manuscript, dated, September 2nd, 1935 Krenkow's copy is now in the USSR The Baghdad manuscript was itself copied again, according to a note by the unanimous copyist (similar

notes are found in other extant manuscripts), from another corrected by Ibrāhīm b. Muḥ b Ibr al-Ṭabrīzī known as Ghaḍanfar (the lion, 1232-1293), at the end of 678/1280 The latter based his, on an earlier corrected one by Zahīr al-Ḥaq Abū al-Ḥamid Muḥ b Mas'ūd b Muḥ al-Zakī al-Ghaznawī in 468/1076 collated with a third corrupted copy full of errors, omissions and confusing statements, especially the "first nineteen divisions of the book" by a certain copyist named Dīyūdūst This intermediary copy was dated in 549/1155, a little over a century after the author s death The earliest reported copy, after the autographed draft of 1051 containing al-Bīrūnī's profused marginal notes, is one dated on the 2nd of Rabī'I, 455/1063 by Abū al-Qāsim Muḥ b Aḥ b 'Abd Allah b al-Ḥasan b al-Ḥusayn b Alī al-Isfahānī

Two, is an important complete manuscript of *al-Ṣaydanah* housed at the Iraqī National Museum Library in Baghdad also, No 1911 (general accession No 828) written in elegant, vowelized Naskh, like the previous one but less organized In 429 plus 91 pages, 14 × 20-1/2 cm, 19 lines pp it contains profuse marginal notes, some inscribed by its donor, the Arab Christian scholar and linguist Father Anastās Mary al-Karmalī (1866-1947), who was a stout promoter of a better understanding and appreciation of the great Islamic civilization and Arabic medieval legacy [2]

Three, is the Brussa manuscript in 133 fols, 19-24 lines, written in Naskh script and housed at the Kurshunlū Jāmi Library in Bursā, Turkey, No 149 Although incomplete, it is possibly the oldest known Arabic copy of this work and dates late thirteenth or early fourteenth century [3] A photocopy of it was made about 1930 for Max Meyerhof by H Ritter From it a manuscript was written by the Egyptian scribe Maḥmūd Sudqī in elegant Naskh, in 385 fols, 21 lines pp, completed on the 20th of March 1936, and is presently housed at the new building of the National Library of Cairo, Egypt, near the Bulaq Nile Kornish [4]

The modern discovery of al-Bīrūnī's abovementioned Arabic copies was made by Aḥmet Zekī Velidi Togan in 1927,[5] and H Ritter and Fr Krenkow and others in the 1930s [6] Thereafter Meyerhof, in Cairo, popularized the book of *al-Ṣaydanah* and emphasized its great importance to the history of Islamic pharmacy He presented a most valuable and penetrating commentary on it together with the Arabic edition and German translation of its introduction and contents (later on he wrote also an explanatory article in French) These two useful papers have shed much light on the books' contents and inspired many historians of the medical sciences including this writer, concerning its significance [7]

Translations of al-Ṣaydanah

The earliest translation of the book *al-Ṣaydanah* was done in Persian It is believed, however, that there was no complete version of the entire work

But despite imperfection of extant Persian copies their study kept the influence of this book alive in Persia and the Sub-Continent for many generations, and had inspired several studies in a few European languages in this century[8] This version also led to a recent, useful edition in Persian with a detailed introduction[9] An English translation with an Arabic edition published in late 1973 by Hakim Moh Said and his associates under the auspices of the Hamdard National Foundation, Pakistan, is the most complete edition to appear thus far[10]

The earliest reported translation in Persian was that by Jalāl al-Dīn Abu Bakr b 'Alī b Uthmān b Asfar (Asghar or Asfara) al-Kāsānī (from Kasan in Transoxiana) who flourished in that area about 607-627/1211-1229 This apparently incomplete and imperfect version, however, became the basis for most later Persian translations of which the following copies are known to me

1 The Tehran copy, housed at the Kitābkhāna-i-Majlis-i Shūrā-i Millī, was written in Naskh in 340 fols, and completed in the 9th/15th century

2 The Isfahān copy, housed at the public city library, written also in Naskh in 187 fols, and was dated at the end of Rabī'I, 983/1576 by copyist Muḥammad b Umar[11]

3 The British Museum copy Or 5849, written in Nastālīq script about 1700, by Muḥammad al-Dahlawi of India The handwriting is good but the manuscript is touched by dampness

4 The Aligarh copy, No 6, housed at the Aligarh Muslim University Library in India It is written in elegant Persian Naskh in 55 fols, 19 lines pp and dated Jumādā 11, 1008/1600 The original introduction as well as the first five chap ers are completely deleted It only contains entries under the first four letters of the alphabet of the materia medica section of the book[12]

The Two Major Sections of al-Ṣaydanah

Al-Bīrūnī's *al-Ṣaydanah* in the original Arabic can be conveniently divided into two major sections, each of which will be briefly evaluated here

The first consists of a prelude and five condensed chapters containing very useful information In them al-Bīrūnī explained methods of researches undertaken, his approach and plans, as well as those of his colleague and assistant, al-Shaykh al-Nasha'ī, and their objectives in bringing this project into satisfactory conclusion The author also defined important areas of the health fields such as the apothecary art, pharmacology, and medical therapy

presenting historical and literary interpretations and data of lasting value, in both prose and verse

In the discussion one is intrigued by al-Bīrūnī's little faith in building private libraries and the reliance on books which were often collected for a show off and not for actual use Instead, he recommended keeping all information by heart and the storing of acquired knowledge in one's memory to lessen dependence on books and written documents Such things, he thought, were always exposed to burning and loss by theft or destruction, but what one treasures in his memory nothing can take away from him Furthermore, memory can keep information for a longer time which can be drawn upon easily and at will Such emphasis no doubt stemmed from al-Bīrūnī's sensitivity to the unpredictable circumstances that surrounded his life and the changing trends throughout the area during his time

For teaching and learning al-Bīrūnī emphasized the use of audiovisual techniques Such means equip the learner and the scholar, through repeated personal observations and involvements, with unforgettable details that could not be acquired and retained otherwise "Thereafter nothing can deprive us of the knowledge that is stored in memory and kept by heart" It could never be lost This attitude cuts under compilers whose only concern is to copy and thus multiply already existing errors in widely circulating compendiums He concluded by quoting an earlier Arabic writer as saying, "that man's real wealth is the undiminishing knowledge he treasures in his memory and which he can easily utilize when needed '

Interestingly, al-Bīrūnī was very frank in explaining his mental and physical condition in his old age In so doing he enlightened our knowledge of his private and scientific life, ambitions, and endeavours at his old age He then proceeded to tell about the situation of the healing art during his time, the prospects for contemporary pharmacists and other medical practitioners, as well as Arabic literary contributions in these health fields He further emphasized the remarkable adequacy of the language of the Qur'ān, being then the *lingua franca*, pointing to the important role it played in promoting useful learning, and esthetic and scientific literary contributions Written with meticulous care and precision, eloquent and charming style, and with remarkable objectivity, this first part of *al-Ṣaydanah* stands, even in view of modern standards, as a masterpiece of noteworthy pharmaceutical literary achievement It presents a monumental contribution not only to the medieval Arabic period, but also to a universal history of professional pharmacy of all times [13]

The second section of *al-Ṣaydanah* contains the materia medica entries conveniently and precisely arranged in alphabetical order According to the two Baghdad copies Nos 48 and 1911, we can determine the number of simples

or entries under each letter of the Arabic alphabet and their total They are as follows —

136 entries under the letter A, 50 under B, 34 under T, 14 under Th, 48 under J, 78 under Ḥ, 54 under Kh, 45 under D, 19 under Dh, 57 under R, 43 under Z, 83 under S, 106 under Sh, 16 under Ṣ, 7 under Ḍ, 28 under Ṭ, 2 under Ẓ, 52 under L, 12 under Gh, 50 under F, 39 under Q, 49 under K, 24 under L, 68 under M, 32 under N, 17 under W, 22 under H, 2 under Lā, and 10 under Y, 1197 in all There are, however, numerous simples and natural products from animal, mineral and plant origins which are mentioned under two or more entries in view of the many synonyms of the same simple and the several overlaps, which bring the actual number to much less than one thousand [14]

In these entries, the author traced the names of simples originating in the three natural kingdoms, their original sources, their finest types, and etymological identification of drug synonyms He compared one type of species with another emphasizing the parts used or illustrated, shapes, colors and other physical properties He described also their habitat, varieties, and particularities as regard growth and propagation, as well as cultivating, collecting and storing of the simples for future use [15]

The subject matter, although in a crude form, falls under the general topic of pharmacognosy in our modern terminology The author tried to avoid, as much as possible, any mentioning of the simples' modes of action, dosages recommended in the various pharmaceutical forms, the parts that are specifically used and their therapeutic applications as he clearly indicated

Frequently al-Bīrūnī cited earlier authors, both literary men and professionals, by quoting their sayings and their assessments of these simples in prose and verse, and by pointing out the most acceptable interpretations He utilized also his unusual linguistic ability as well as his vast knowledge which he acquired in the field of natural history through travels in the Asian sub-continent and neighbouring lands He thus contributed a great deal in the identification, description, and classification of these important curing agents provided by mother nature for human utilization and physical welfare [16]

In this second section furthermore, al-Bīrūnī illustrated his profound appreciation and admiration of the natural sciences and his acquaintance and exposition of the available medico-botanical literature In his concentrated effort to demonstrate the physical properties of drug simples he established a foundation for the separation of what we term pharmacognosy from pharmacology This part of *al-Ṣaydanah*, therefore, stands as one of the best and the first of its kind presented in any language up to the European Renaissance

For the purpose of elucidating the general scope of the flora, fauna, and mineral ores which were considered and described by al-Bīrūnī here, several examples will be mentioned They were selected at random to acquaint the reader with the author's interest and concern about ecology, medical botany and zoology [17]

Animal Products in Pharmacy

The following are examples of simples of animal origin mentioned in al-Bīrūnī's materia medica

1 Swallow, sand (crag or house) martin (Ar *Khuṭṭāf al-Shaṭṭ* or *al-Juruf*), Hirundo riparia or Colvle riparia, Fam Hirundinidae, found on sandy seashores

2 Hystrix, porcupine (Ar *duldul daldal, Shavham, al-Qunfudh al-jabalī, Shayzam, nayṣ*) a genus of terrestrial porcupine, Hystrix cristata, Fam Hystricidae, an animal slow in motion, indigenous of the Mediterranean region, about two feet long and uses the thorn on its back for defence It digs its own hideaway deep in the ground with one opening only for entrance and exit Related species include the chinchillas

3 Cantharis, Cantharidis, lytta, blister beetle, and Spanish fly (Ar *dhurārīh* pl of *dhurrāh, dhubāb hindi*, and *ukhayḍar*), Cantharis vericatorius Latr order Coleoptera, Fam Meloidae, a two winged flying insect larger than the common fly, veined and multi-colored (red, yellow and black) In modern pharmacy, they collect them before sunrise by shaking them down the trees They are then killed by the use of certain chemicals and stored for therapeutic usage Al-Bīrūnī was silent regarding the method of collecting them in his time, but he cautioned against their poisonous nature

4 Nicolar or rock-dove (Ar *Shifīn barrī*) a land animal whose meat al-Biruni considered, after that of pigeon, the most nourishing food in geriatrics (*fāḍilat al-ghidhā'*) having a miraculous power to help build blood in anaemic people (*lahā Quwwah 'ajībah fī ṣarf al-damm 'alā al-qalīlī al-dimā'*), a noteworthy observation of great therapeutic value The author spoke also of the marine type, ray, skate or rockfish (*Shifīn bahrī* or *rajā*), Fam Scorpaenidae, a fish that lives among rocky bottoms and resembles the vespertilio bat It has two fins and a colored tail in the shape of a thorn by which it can bite [18]

Fungi, Mushrooms and Toxicology

Al-Bīrūnī also described several fungi, mushrooms and potent or poisonous simples found in nature

1 Maltese mushroom or scarlet cynomorium (Ar *ṭarthūth* sing of *ṭarāṭīth, masrūr*), Cynomorium coccineum L , Fam Cynomoriaceae, a triangular, thin plant that resembles the mushroom Its reddish color is like the scarlet containing a dyeing substance used in tanning The roots have a bitter taste but the top parts near the buds are good tasting As a remedy for stomach-ache it was called *dabbāgh al-ma'idah* as it coats the inside of the stomach, a reminder of widely publicised anti-acid remedies of our time Al-Bīrūnī tells also how this mushroom was brought for sale at a city he knew (possibly Ghaznah) and how each load of this plant fetched about a hundred dirhams Much demand and high price led to its adulteration by mixing it with cheaper substitutes

2 Black nightshade, fox grapes (Ar *'inab al-tha 'lab, 'ubāb, al-Fīnā, al-ribrāq*), varieties of the Paris incompleta M Bieb or Solanum nigrum L , Fam Liliaceae This plant grows in rocky or sandy areas far from water resources and is used as a soporific, hypnotic and somniferous Overdoses were reported to be fatal, and al-Bīrūnī thus warned against their poisonous nature In folk medicine, a tale has it that eating the seeds will bring lovers closer together Evil spirits, however, through jealousy and envy draw holes in the seeds rendering a potent and useful drug ineffective But if the wholesome black seeds or berries with black dots the size of chick peas 5—6 in each sheath were pounded and applied externally in a poultice, they relieve pain Poets praised its durability, usefulness and beauty in verses of which we quote the following two

و على الاحراج الوان الفنا   و حزامى الروض يعلوه الزهر
و ادغاً

كان لثات العبن فى كل مسرل   برلى به حب الفنا لم يحطم

3 White larch, agaric or purging agaric (Ar *ghārīqūn*), varieties of the rounded fungus of Fomes, Agaricus officinalis Faull , Fam Polyporaceae It is an airy, earthly, and firry fungus which originates from corrupted matter and decayed trunks of trees The best type, according to the author is the very white, light and sweet at first, but turns bitter later on, and is easy to rub on It grows on trees like the mushroom

4 Truffle, white truffle, tuber (Ar *Kamāt, Shahmat al-arḍ* and *fiṭr*), any of a number of related fleshy, edible and potato-shaped fungi, Tuber album Sow, which grows underground The white type is called in Arabic *fuq'* and *'asqal*, because it breaks the ground and

with very little effort it shoots upward especially after rain or thunder While describing it, al-Biruni amusingly tells the following joke He explained, "a certain unrespectable person asked a clown, 'Do you know me?' 'Yes', the clown answered 'You are like the truffle having no actual roots nor real branches' "

It seems clear from the text and the author's many quotations or earlier references that the Arabs were aware of several kinds of truffles and mushrooms edible and poisonous, since the pre-Islamic period

5 Indian lilac, bead, china or margosa tree, azederach, sesban or danchi plant (Ar *azadarakht*, *izdarakht*, *saysabānah*, *zanzalakht*, *zilzilakht* or *al-wann*), varieties of the Sesbania aculeata Poir fam Leguminoseae or Melia azadirachta It is also called in Arabic *'alqam* (colocynth or bitter apple), a word later was applied to all bitter tasting things The very fragrant, white-yellowish fruit is the size of lotus jujube and looks like the chebulic myrobalan with branches and the color of flowers resembling the yellow gilliflower (bleeding heart, Cheiranthus cheiri L fam Cruciferae) The plant grows in abundance in Jurjān where they distil it to obtain aromatic water (*al-wann*) known at al-Rayy as *halīlaj* (*halīlij*) The fruits are very poisonous while the branches serve as an antidote [19]

Gums, Resins and Dyes

Al-Bīrūnī was explicit about gums, resins and dyeing products among his simples

1 Gum ammoniac (Ar *Ushshaq*, *ushshaj*, *samgh al-Kalkh* and *luzzāq al dhahab*), a gum-resin obtained from the stem of Dorema ammoniacum Don fam Umbelliferae, of which the best kind was the compact, cohesive and the clean (free from impurities) It resembles the olibanum having a strong smell and a bitter taste The author denied the claim that this natural resin gum comes from the indigenous Persian, ushturghāz tree or juniper (Juniperus oxycedrus L) which resembles the snake cucumber and tastes like the extract of poppy

On another occasion al-Bīrūnī spoke of the presence of ammoniac (as a mineral substance) in the urine, a statement of importance to the history of bio-medical chemistry A similar simple mentioned in Dioscorides is the Ferula tingitana L

2 Gum Arabic (acacia or senegal), acacia (Ar *aqāqia*, *al-sinf*, *al-simgh al-'arabī*, *umm ghīlān*, *faql*, Karaz, and Qatād), Acacia senegal L was known in Arabia and Egypt since remote times It was

employed in eye medications as well as in seasoning It flows from the trunk of the ripe tree upon incising it The juice (*'uṣārah*) is the sap collected before ripening time by pounding certain parts of the plant then squeezing out by applying force But the rob (*rubūb*, the condensed thick juice) is obtained by boiling the pounded parts of the plant with water until all important principles of the drug are extracted Thereafter the extract is strained and left in the sun to dry or cooked to evaporate excess water to bring it to the right thick consistency

3 Indigo (Ar *al-nīl* or *nīlah* from the Sanskrit *mīlah* meaning dark blue), Greek indecon, various species of the Indigofera tinctoria L, fam Leguminoseae "It grows in the whole region from Maghuz and Lashgard to Hurmus and is carried from these eastern shores by sea It is also found in the area of Kalur and Lahore but the best known kind comes from Lamaghan" This substance does not spoil or rot on standing or in storage like some other simples

Although one variety of this plant abounds in Southern Arabia, its popular usage there differs from that of the Indian indigo The type of seeds known in Arabic as *hab al-Nīl*, the Ipomoea hederacea Jacq Fam Convolvuloceae, are used as a purgative[29]

Mineral Ores in al-Bīrūnī's al-Ṣayadanah, five examples

1 Ceruse or white lead (Ar *isfidāj*, *isfidhāj* and *rithnīn*), a transparent mineral stone, glossy white or yellowish (modern basic lead carbonate)

2 Vitriol, asramentum (Ar *Zāj*) includes varieties of chemical compounds Al-Bīrūnī considered the golden type the best which when broken reveals the shapes of golden stars In potency the golden is similar to the green vitriol (impure iron sulphate) often confused with the cobbler's vitriol which turns green when calcined These and other vitriols, the author reported "dissolve in water with the exception of the Syrian red vitriol [basic iron sulphate]

Galen mentioned three types of vitriols he found in a stone at Cyprus He considered the white [crude zinc sulphate or white copperas] the most effective and useful in therapy

3 Verdigris (Ar *alqadish* or *alqadīs*, *zinjār* or *zunjūr*), a mineral [modern green copper acetate] dug from copper mines, then treated with wine and not vinegar to obtain its "extraction" If

the verdigris was adulterated or wrapped in cloth and heated in fire it turns red It may be also prepared by mixing alum, bawraq (crude sodium and potassium carbonate) and natural salts (these include table salt) with vinegar and urine in a mortar to a uniform mixture, then heated in the sun to thick consistency for external use, or in long worm-shaped suppositories Most of the known types of verdigris act as a potent astringent in medicine as described by the poet in the amusing and satirical two following verses

بطى عن الخير لكنه　　　　الى كل شر سريع كمش

لقد لويت فيه سوء الطباع　　　　كما لوى الدهن فى القلقدس

4 Alum (Ar *al-Shabb*), found in many types and in different lands Supply sources in al-Biruni's time include Egypt, Sardinia, Phrygia, Armenia, and parts of Greece and North Africa The author exhibited his skill in describing the astringent and contraceptive therapeutic effects of the three following types The new, extra sour white alum that splits easily and which he considered the finest, then the astringent rounded type and finally the wet which gets moisture on exposure

5 Mummy, pissasphalt, water wax (Ar *mūmiyā'*), "a mysterious substance about which not much is known as regards to its origin and true nature It had been said that in Persia it was stored in a special, safely locked chamber or a treasure house kept under guard" Like the Japanese Shosoin Imperial treasure house at Nara,[21] this one in Persia was opened once every year, under order from the King, his advisers, or the mayor of the city Near the treasure house they erected a large strainer After cooking the *mūmiyā'* in water, they allow the filtered water to pass through a trough and a canal, while the *mūmiyā'* remains and congeals over the strainer It is then collected fresh and stored in the King's repository Al-Bīrūnī quoted some Arabic authors who spoke of it as another type of asphalt, black bitumen or a pitch which is brought to Ghaznah from far-off countries Others considered it a type of resin-gum which is collected from mountainous areas These differing propositions prompted our author to collect further data to explain the mystery of this drug and which was widely spoken of and presumably utilized in therapy It was also frequently reported in medical compendiums Because of such investigations al-Bīrūnī's *al-Ṣaydanah* is not only a mere text on materia medica but also a thesaurus of information gathered on many natural products used by many in his time in everyday life[22]

Drugs from the Vegetable Kingdom.

Like many materia medica texts up to the Renaissance most of the simples discussed were of a plant origin Here are a few examples of those plants described in *al-Ṣaydanah*

1 Mugwort, motherwort (Ar *habaq al-rā 'ī, shuwaylā', baranjas*), varieties of the Artemisia vulgaris L, Fam Compositae The water mint is Arabic *habaq al-mā'*, Mentha acquatica L, Fam Labiatae Holy monk or holy basil (Ar *habaq al-ruhbān, shahisfaram*, or *rayhān Sulaymān*), and sweet or common basil (*habaq hindī, hawk* or *badāurj*) are varieties of Ocimum basilicum L, O filametosum Forsk, or O minimum, a fragrant plant indigenous to India

The author also mentions the stinking ground pine, Camphorasma glabrum L, Fam Camphorosum, which smells like camphor and is used in therapy The wild or field basil or horse thyme (Ar *habaq barrī*) with its rosy flowers, is a variety of the Calamintha clinopodium, Fam Labiatae

2 Lizard orchis salep (Ar *juftafrit, sahlab, Khuṣa al-Kalb* or *al-tha 'lab*), Orchis hircina Crautz, Fam Orchidaceae Because of its beautiful fragrant flowers al-Bīrūnī wrongly associated it with the Persian *qftab parast* or sunflower Yet he correctly described how the intertwined roots extend in rows of pairs (*Jurmūj* and *shāṭiryūn*), one is small and soft, while the other is large They look like two olives, full and bulging Because of their supposed aphrodisiac effects, folk medicine has it that "if a man eats the larger roots his offspring will be males, but if a woman eats the smaller type she begets females If, however, the larger was eaten after the smaller type or vice versa, the effects of one cancels those of the other" Like many other simples described by the author, this plant is listed in two entries according to the letters of the synonyms used

3 Cardamom seeds, grains of paradise, malequetta pepper (Ar *hāl Khiyrī, hal bawwa, al-Khashki, aqullah* or *habb al-hal*), varieties of the Amomum malequetta Rose, Elettaria Cardamomum Maton, or Alpinia c Roxb, Fam Zingiberaceae, a perennial plant with fragrant seeds which enter cosmetics and in therapeutics for treatment of stomach-ache Al-Bīrūnī discussed the two types of seeds or capsules The large (major), and the small (minor) both indidigenous to South India, Indo-China and Ceylon The sheaths of the capsules resemble wild rue nuts and contain the black seeds which are like coriander seeds with camphor-like odor

4 **Iris, blue or azure lily, fleur-de-lis, blue flowers de luce, flowering flag (Ar *irsā, sawsan ismānjūnī, zanbaq azraq, qānā, Kaff al Ṣabbāgh*),** varieties of the Iris Germanica L , I florentina or I pallida Lamarck, Fam Iridaceae, a common plant, according to al-Biruni, with a stalk that carries nodding flowers (leaning down) It has three broad leaves covered inside three larger ones alternating in position with different colors in parallel lines white, yellow and purple and an overall navy blue color with dots and lines that look like an iris The roots are firm and tight containing fragrant knots that rot with age or become worm eaten giving out further aroma If pounded forcefully the vapors cause sneezing

Many varieties of the iris exist in the region where al-Bīrūnī resided in the Sub-Continent including Afghanistan thus becoming a familiar, widely cultivated, ornamental plant to al-Bīrūnī and his contemporaries For this reason, unfortunately, he neglected to describe it in detail apologizing by saying that "it does not seem necessary to dwell on a detailed description of its commonly known physical properties" In so believing, al-Bīrūnī unintentionally deprived later generations of important and first hand information on this and other similarly common plants which he knew so well and his keen personal observation would have been most valuable He however commented on its uses as a sedative, sleep-inducing drug and which gives relief in chronic headaches Its mixture with vinegar was recommended as an antidote against poisoning

5 Welled (white) thistles, camel thorn, long spined cotton thistle, or Hebrew manna (Ar *firyās, bādāward* or *bādhāward*), believed to be the Picnomon acarna Coss but more accurately the Ono pordon acanthium L , or O macracanthum Seh Fam Compositae, the same species as that of cotton thistle or wild artichoke, as al Bīrūnī believed and rightly so Other later Arabic authors including Ben Maymun (Maimonides) disagreed

The plant has light crowded branches that occasionally are pulled out and carried away by strong winds Another species, the alhagi tree (Alhagi manniferum Desv) has white nappy leaves and long, hollow stalks which culminate in pointed heads that carry purple flowers

6 Turpentine tree, terebinth or oak (Ar *siyāh dawarān, ḍirāwah, buṭm, ballūṭ*), varieties of the Pistacia terebinthinus L Fam Liliaceae which is related to the aloes (Aloe vera L) Arabic *al ṣabr* or *al-maqr*, which has white flowers and bitter tasting pungent fruits, has also solid roots that look like pegs or wedges Its gum was

brought during al-Bīrūnī's time from India, Arabia and Asia Minor He also stated that the aloes was exported by the Christian natives of Socotra island governed then by an archbishop "These inhabitants were reportedly transferred to the island from Greekland by Alexander the Great after his conquest of the East" The gum was used in internal medicine, but the type imported from Eden in Southwestern Arabia was employed for external use only in the form of an ointment or a paste

In describing the method and technique used in preparing aloes for external medication, al-Bīrūnī relied on Ibn Jurayh The Indian aloes, however, known as calambac or agallochum (Ar *'Ūd al-Nadd* or *al-'Ūd al-hindī*), of the species Aloexylon agallochum Lour when mixed with ambergris and musk was employed in perfume manufacturing and "One *mann* (two pounds) sold for three hundred dinars or more Indeed since the fragrance of the perfume is so exquisite there will be no telling of the high price it fetches," al-Biruni reiterated Thus much folklore developed around the origin and supply sources of this highly priced ingredient

7 Thepsia, wild rue (Ar *Thāfsiyā, ṣamgh al-Sadhdhāb al-barrī al-jabalī*), of the species Thapsia garganica L Fam Umbellifera For obtaining the gum, the author recommended making circular cuts in the trunk of the plant or the leaves and collect the sap Because of its sharpness and repugnant smell, al-Bīrūnī cautioned the collector of the sap to keep his face away from it "If splashed on the body the sap causes swellings and blisters on the face, joints and other parts of the skin wherever it touches" For treatment, therefore, al-Bīrūnī recommended rubbing the affected place with freshly pounded garlic

8 Common box tree, orange ball, Boxus sempervirens (Ar *'athaq, 'athar, baqs,*) species of the Buddleia asiatica Lour order Sapindales and Fam Loganiaceae, extensively cultivated but not edible The shrub reaches over five feet tall and grows on mountain tops and high altitudes The twigs when pounded and boiled in water, their thickened extract can be used in a paste as a hair remover, just as the nawrah does

9 Mudar plant, calotropis (Ar *'ushar, diudār, yatū'*), varieties of the Calotropis procera Ait or C gigantea, Fam Asclepiadaceae, indigenous to Pakistan, India, Ceylon and tropical Africa It grows upward in valleys, "and because of its bitter taste the cattle avoid eating it" The leaves are broad and the fruits are light They easily fall to the ground and are collected from around the trunk They are cooked with water, strained and the filter is

poured into molds resembling sugar cones to be stored in treasure boxes by even nobles and kings for future medicinal use The stalks are thick, soft and squashy resembling women's legs and arms Al-Bīrūnī adds that it yields caustic puff and bubbles most useful in cautery

10 Towel gourd, rag-gourd, vegetable sponge (Ar *lūf, rans, lūf al-ḥayyah*), varieties of the Lucuma aegyptiaca Mill or L luffa L, Fam Cucurbitaceae, edible but pungent like the large cuckoo-pint which is often used as an expectorant in therapy Al-Bīrūnī tells how al-Kindī recalled the story of a Muslim prisoner of war who was held by the Byzantine army in Anatolia Prisoners there were given blackish, molded bread which is hard to eat or digest "This prisoner asked for a specific plant which he said will change the taste and condition of the flour It was the bulb and leaves of the luffa plant which resembles the beets that he used He mixed it with the flour first and baked it The treated bread recovered its purity of color and good taste The people of Anatolia since, include it in their treasured fruit conserves and robs The twigs sprout from the midst of the trunk up, while the fruits ripen at the top The white bulbs which eventually turn yellow were used in medication causing numbing and anesthetic sensation of the tongue", the author remarked

These examples throw some light on our knowledge of the many areas to which al-Bīrūnī's book contributed As regards to pharmacy and general pharmacognosy, he not only gave meticulous definitions and identification of these fields but strictly limited himself, except on a few occasions, to describing the physical properties of the materia medica He treated these simples as products provided in nature and pointed to their synonyms and relation to ecology He gave explicit and original description of land creatures and fishes and their mode of life As to the vegetable kingdom, he enriched Arabic medical botany with useful data on important medicinal herbs, shrubs, fungi and mushrooms

From his early youth and throughout his life, al-Bīrūnī seems to have had a real interest in collecting and studying flowers and aromatic plants including sweet basils and the like It may be possible to speculate that these kinds of interests and involvements were responsible for the appellation he had before his actual name, Abū al-Raiḥān, as a nickname (generally meaning a man who had such a close affinity to the collecting, studying, and propagating flowers and aromatic plants) This intellectual genius who, to our knowledge never practised the healing art as a career, had added much information to Arabic toxicology, mineralogy, therapeutics, zoology, and botany, of lasting value.

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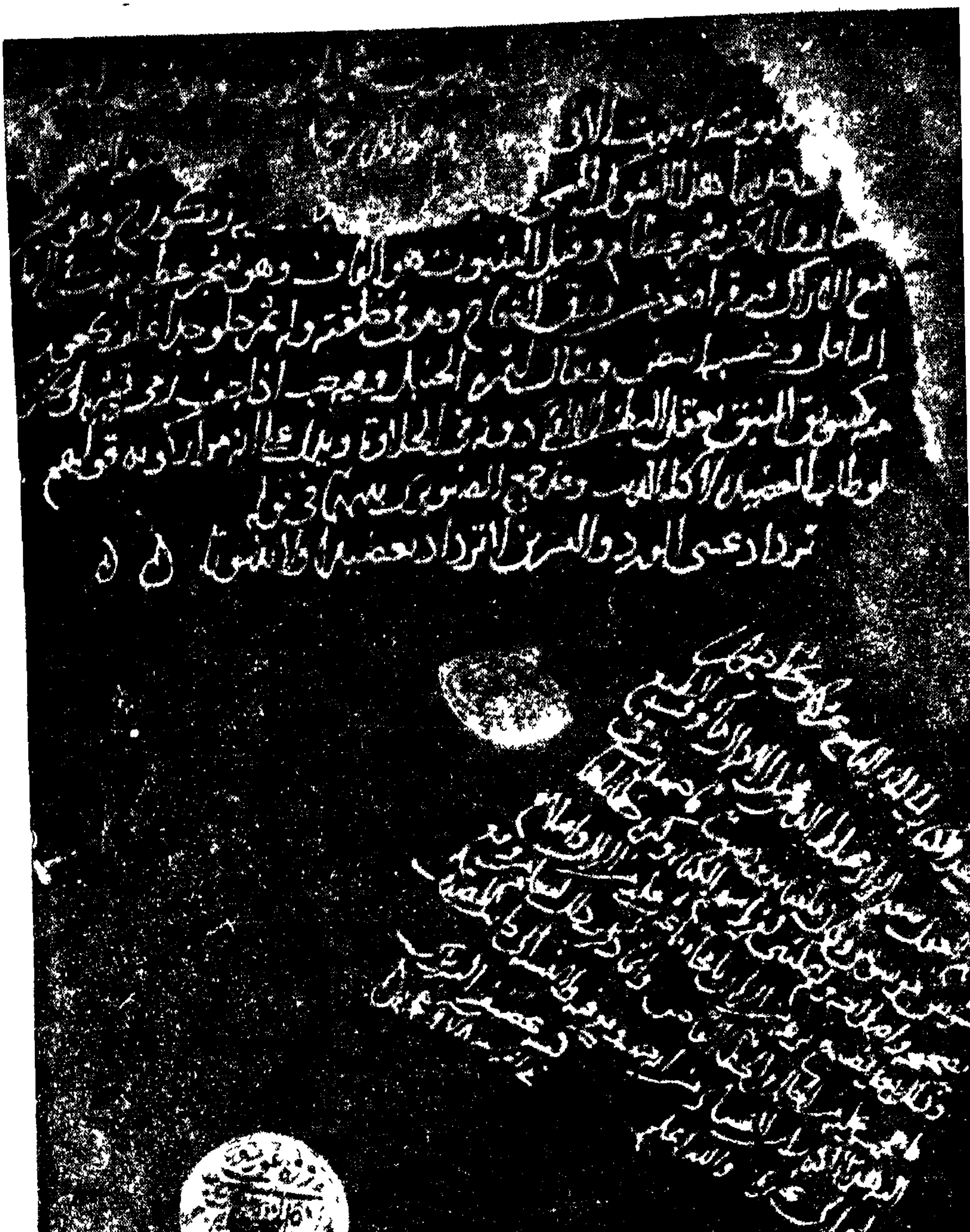
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AL-BĪRŪNĪ AND AL-HAYTHAM:

A Comparative Study of Scientific Method

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Introduction

HISTORY of science is a relatively young academic discipline in modern institutions of learning, the individual sciences have grown hypertrophically, leaped forward to magnificent achievements, but also into ever greater independence and isolation Man has been unable to catch up with these breath-taking advances, to integrate them into a unified human consciousness, the essential condition for an unrestricted and wholesome participation in all the macro- and microcosmic processes on which man's entire life depends So in recent times ever more people, including specialized scientists, have become aware of the need to trace the historical development of the sciences

Too often, though, this branch of history is guided by rigidified modern conception of its specific object science, not as one of man's activities only, but as the abstract, superhuman force, pictured as the ever triumphant conqueror of ignorance throughout the ages The result is, as we all know too well, a flood of books and pamphlets that look so frighteningly alike Lists of discoveries and inventions, ascribed to people of whom we seldom get to know much more than their names and such vital statistics as birth and death These data are often enough the only thing that suggests a measure of historical awareness, for a man's scientific activities are carefully isolated from his other, supposedly less important, concerns in contemporary and local society, religious movements, philosophical schools, etc —No, if the history of science is to have a sounder basis than a dehumanized abstraction, it has to study science as the science of man, man the scientist being the center of its investigation, its fundamental reality

A hopeful beginning, it seems to me, has been made by historians of science in antiquity and the Middle Ages, although they often do not guard carefully enough against the common trend of making rash comparisons with the achievements of the Renaissance or modern times, before the work of these

earlier scientists has been duly studied and appreciated in itself Thus A C Crombie's pioneering studies on Robert Grosseteste and his contemporaries[1] led to an increased interest in the methods and philosophical preconceptions of medieval scientists, not only their crystallized results, but even more their characteristic attitudes, and methodological choices that occasioned them, In short, their personal involvement as humane in scientific tasks, has become the more interesting 'object' of a history of science that is more truly a branch of history

As far as the history of science in the Islamic countries is concerned, these broader, more human aspects of scientific development can still not be said to get the attention they deserve In too many cases the basic texts are not even analysed and published yet, so that doing research in this area usually means that first the painstaking job of establishing the individual texts and their contributions has to be done In some cases, however, thanks to the efforts of generations of devoted orientalists, this indispensable work has been completed already, or has at least progressed very far And fortunately, this can be said of two of the greatest scientists in Islamic history Al-Bīrūnī and Ibn al-Haytham Thus the impatient student may be allowed to look ahead once and, relying on the ground-work laid by great scholars, gather some clues that cast light on the works of these two scientists, their origins and methods This is done by way of comparison in order to give greater contrast to the characteristic features In the case of al-Bīrūnī and Ibn al-Haytham this procedure promises to be specially fruitful because they were contemporary Muslim scientists whose works covered so much the same ground that both men could be called "another Ptolemy"[2], but who lived so far apart from each other—and in such different states as Fāṭimid Egypt and Sunnī Ghaznah that they apparently never came to know of each other's existence

I have to admit I was quite pleased to find out that Eilhard Wiedemann, some forty years ago, already planned to write a comparative study of Ibn al Haytham and al-Bīrūnī,[3] this assured me that I was not after something unreasonable and useless, although I can hardly hope to provide a substitute for a study which this great pioneer of Islamic history of science had not had the time to carry out

I *Ibn al-Haytham, the Ingenious Physicist*

Although a distressingly big number of the works ascribed to Ibn al-Haytham and al-Bīrūnī are lost without any hope of recovery, both men—and the destructive forces of the turbulent centuries that divide us from them—were good enough to leave us lists of their own writings and autobiographic reflections Any study of their scientific works, and especially a comparative evaluation that tries to lay bare the roots and methodological orientations of their science, will therefore be able to start from their own explicit statements

Further details, however, will then have to be gathered from their other extant literary compositions, and only a careful reading of these works can show how far their scientific programs and methodological reflections have been carried out and where they have led

To start with, the older one of the two men,[4] Ibn al-Haytham is never satisfied to just state the facts as they present themselves, he always has to inquire into the causes, to ask the question 'why?', thus he reflects on what made him a scientist and led him to his many discoveries, but this time he contents himself with an admission of ignorance

> "I do not know how I attained to (what has been written down below) since the time of my youth You may say, if you so wish, it was through a miraculous coincidence, an inspiration from God, a fit of madness, any other cause or whatever pleases you "[5]

He has no answer to this question, but he is fully convinced that nothing is more valuable and bringing man closer to God than the search for truth and knowledge

This search - as Ibn al-Haytham sums up years of experience - has to be an independent one that endeavours to penetrate to the very roots and principles of knowledge and is not satisfied with what the traditional authorities have said about the matters under investigation Considering the fact that steadfast loyalty to such authorities has determined intellectual history for thousands of years and has still a greater effect than we like to admit, Ibn-al-Haytham's critical attitude deserves all the more attention, especially since it follows from the mature experience of a great scholar In his words

> "Since my youth I have constantly reflected on the views of various people concerning their doctrinal convictions, every group of them tenaciously holds on to what it deems right according to the view that has taken form I began to doubt about all this, for I became convinced that there is only one truth, and that its differing conceptions merely stem from the methods used in the investigation '[6]

A few words first about the critical part of this puzzling text Sometimes it has been taken in isolation and interpreted in a restricted theological sense, as if Ibn al-Haytham had lost his faith in Islam or any existing religion and become a modern atheist If his other writings are taken into consideration, it will appear that this interpretation is inspired by modern anti-religious dogma rather than by textual evidence What Ibn al-Haytham in fact came to extol above everything else is a commitment to truth for its own sake, independent

of school traditions and sectarian dogmatism, and although he has the highest regard for Aristotle and Ptolemy, whom he is happy to accept as master and guide, he nevertheless advocates the most vigorous criticism of any scientific writing His program of methodical criticism should be at least as well known as that of the much later Descartes –

> "Truth is sought for its own sake And those who are engaged upon the quest for anything that is sought for its own sake are not interested in other things Finding the truth is difficult, and the road to it is rough For the truths are plunged in obscurity It is natural to everyone to regard scientists favourably Consequently, a person who studies their books, giving a free rein to his natural disposition and making it his object to understand what they say and to possess himself of what they put forward, comes (to consider) as truth the notions which they had in mind and the ends which they indicate God, however, has not preserved the scientist from error and has not safeguarded science from shortcomings and faults If this had been the case, scientists would not have disagreed upon any point of science, and their opinions upon any (question) concerning the truth of things would not have diverged The real state of affairs is however quite different Accordingly, it is not the person who studies the books of his predecessors and gives a free rein to his natural disposition to regard them favourably who is the (real) seeker after truth But rather the person who is thinking about them is filled with doubts, who holds back with his judgement with respect to what he has understood of what they say, who follows proof and demonstration rather than the assertions of a man whose natural disposition is characterized by all kinds of defects and shortcomings A person, who studies scientific books with a view to knowing the truth, ought to turn himself into a hostile critic of everything that he studies he should criticize it from every point of view and in all its aspects And while thus engaged in criticism he should also be suspicious of himself and not allow himself to be easy-going and indulgent with regard to (the object of his criticism) If he takes this course, the truth will be revealed to him and the flaws in the writings of his predecessors will stand out clearly "[7]

The second, i e positive, part of Ibn al-Haytham's autobiographic statement quoted above takes us into the heart of his scientific originality "for I became convinced that there is only one truth, and that its differing conceptions merely stem from the methods used in the investigation " This unitary view of truth gives the characteristic vigour and direction to all scientific projects and achievements of Ibn al-Haytham, according to the first list of his writings, transmitted by Ibn Abī Uṣaybo'ah, he also wrote special treatises in support

of this unitary view, however, they do not seem to have survived the destructions of history. Only their titles are still known —

> "Treatise on the fact that there is only one method of attaining truth" (nr. 25), and
>
> "Treatise on the fact that there is only one proof, but that it is applied as a constructive one (*ṣinā'ī*) in geometrical questions, and as a dialectical one (*kalāmī*) in the physical and metaphysical questions" (nr. 26).[8]

Since these general methodological treatises are lost to us, we have to turn to the introductions of the extant works, almost all of which contain a concise explanation of his methodology, and to these works themselves. What is most characteristic in Ibn al-Haytham's works is first the careful analysis of his object of investigation that allows him to distinguish its various scientific aspects, and then - with the simple consistency of the true genius - the combination of the appropriate methods for the study of these aspects,[9] for the truth of the matter is only one, no matter how many different aspects, and correspondingly methods, the mind of the scientist produces. And it seems that Ibn al-Haytham gives preference to such objects and problems that more obviously permit or require the combined use of different scientific methods, his favourite one is doubtlessly light, and it is in optics where he made his most famous discoveries. He wrote a separate treatise on light in which he gives us a very clear and concise elucidation of his approach as scientist:

> "The discussion of what light is belongs to the natural sciences, and the discussion of the manner of radiation of light requires the help of the mathematical sciences because of the lines along which the rays of light extend. Similarly, the discussion of what the ray is belongs to the natural sciences, and the discussion of its form and shape belongs to the mathematical sciences. Similarly also the transparent bodies through which light passes. The discussion of what their transparency is belongs to the natural sciences, and the discussion of the manner how light extends through them belongs to the mathematical sciences. So it is necessary that the discussion of light and ray and transparency belongs jointly to the natural sciences and the mathematical sciences."[10]

This method of jointly using the tools and arguments of different sciences for the same object of investigation is something surprisingly new, according to M. Schramm's thesis,[11] as new as Galileo's turn to modern physics, only - Ibn al-Haytham lived some 600 years before the great Italian scientist. For as the many examples of physico-mathematical research with frequent recourse to experimental observation in Ibn al-Haytham's various optical works show, his science is already - at least in this particular field - that systematic use of mathematical functions for the description of physical processes which, since

Galileo has marked the swift progress of modern physics Surely, he still sounds quite Aristotelian when he speaks of light as a substantial form; but for him the intensity of this form can mathematically be described as a function of the angle of refraction, for instance

The consequences of this new approach to scientific problems are naturally quite far-reaching Physics deals no longer merely with abstract principles, aiming at the philosophical description of the natures and qualities of the various substances, but with the operational effects of these things that can be measured and mathematically formulated in functions And since Ibn al-Haytham's primary object of physical research is much a universal phenomenon as light, being part of the sublunar as well as of the supralunar world, his new physics extends quite logically to the planets and stars, while with Galileo the laws of earthly mechanics are simply projected on the movements of the heavenly bodies Astronomy, consequently, is in Ibn al Haytham's view of the sciences not limited to purely mathematical circles and spheres, invented to "save the phenomena", but it deals with the real movements of the heavenly bodies and therefore also real spheres

The consequences for mathematics, especially geometry, are even more staggering, as appears principally in his short treatise on space, a remarkable elaboration of the basic Aristotelian conception, but far beyond Aristotle [12] Space is for Ibn al-Haytham no longer identical with the surface of the surrounding body, but it is an imaginary three-dimensional entity that consists of the dimensions extending between the opposite points of the area surrounding an imaginary vacuum However it does not exist in an absolute sense, as he seems to have clarified in a special treatise of which we only have the title' "Treatise on the non-existence of an empty or a fully occupied space beyond the heavens" [13] In any case, spatial extension, the very basis of geometry, is seen in correlation with the physical interaction of bodies to such an extent that the path of light as the straightest possible line is actually proven by way of experiment Surely, this particular experiment is not very fanciful at all A beam of light is simply collated with a straight rod and declared straight because no divergence can be perceived But it is remarkable that early in the Middle Ages the straightness of light beams is neither simply taken over from the long tradition of optics nor deduced with the help of *a priori* principles, but is seen as merely the physical agreement with a standard taken from ordinary sense perception Is it too much to say that quite modern developments in science are fore-shadowed in this unusual scientific attitude of Ibn al-Haytham?

II *Al-Bīrūnī, the great Mathematician*

This mathematical point may lead us over to the discussion of the scientific methodology of al-Bīrūnī, surely one of the greatest mathematicians of the Middle Ages To consider his work after that of Ibn al-Haytham will make it

easier for us to select the essential features of his approach as a scientist which otherwise tend to get lost in the very extensive and variegated investigations, calculations and historical accounts that make up his major writings And al-Bīrūnī has not reflected so intensively on his own method as did his great contemporary Ibn al-Haytham

The contrast between the two contemporary scientists is quite obvious from the beginning While Ibn al-Haytham, as he himself informs us, endeavoured systematically to absorb and further develop the Aristotelian treasure of knowledge, scientific work seems to have come quite spontaneously to al-Bīrūnī, almost as the natural outflow of his rich personality All his books bear this mark of effortless, and sometimes playful, ingenuity, one does not mind his numerous digressions at all, because whatever he writes is highly interesting and - inspite of his mathematically concise language - extremely informative It is curious how the great al-Bīrūnī in his old age reflects on his awakening interest in science early in his childhood, namely in the preface of his last book, the ***Kitāb al-Ṣaydanah***, which he apparently left unfinished [14] A foreigner, who appears to have been a Byzantine merchant, travelled through young Abū Raiḥān's hometown and gave the child an opportunity to inquire about foreign names for the familiar objects of his environment This little incident is characteristic of large sections of the later "master's" scientific publications Precise descriptions of corresponding systems used in different nations for astronomical or astrological calculations, fixation of calendars, geographical determinations, mineralogical and pharmacological handbooks, philosophical speculations, etc Their scientific value rests less in forward-looking inventiveness than in their exact and objective manner of description and the enormous amount of information they contain

For al-Bīrūnī all scientific research seems to hinge on one or the other branch of mathematics, and mathematics itself is rooted in man's nature

> "Counting is innate to man The measure of a thing becomes known by its being compared with another thing which belongs to the same species and is assumed as a unit by general consent Thereby the difference between the object and this standard becomes known"[15]

This natural drive of man to count the objects around him, and to establish a quantitative correlation among them, accounts for most of al-Bīrūnī's scientific work, although he himself also repeatedly stresses usefulness of knowledge as an important motive for his own research and the promotion of science in general Since this usefulness is, in his view, primarily the one to religious man, as he emphasizes even in such a technical book as the ***Kitāb Taḥdīd al-Amākin***, science assumes a certain religious overtone

> "We look around and we see that man's efforts are directed only towards earning a living, and for this purpose he endures hardships

> and fears, though he needs his food only once or twice a day for his life in this world But he pretends ignorance and neglects what he must not fail to do for his soul in the hereafter, five times in every day and night, thinking that his ignorance is a valid excuse, though he has the opportunity and the power to know it (what is good for his soul)
>
> The Jews also need a direction, because they turn in their prayers to the Temple in Jerusalem which is of known longitude and latitude - The Christians need the (direction of) true east because their elders, whom they call fathers, prescribed to them that they should turn to Paradise in their prayers "[16]

This whole perspective is strikingly different from Ibn al-Haytham's science for science's sake, but this text should not mislead us either, as if truth in itself was not beautiful enough for al-Bīrūnī, "for (as he says in the same book) the intrinsic worth of a thing is different from the casual material benefit that it brings in its train" [17] And it is knowledge in itself that makes a true human being of man

> " It is knowledge, in general, which is pursued solely by man, and which is pursued for the sake of knowledge itself, because its acquisition is truly delightful, and is unlike the pleasures desirable from other pursuits "[18]

Furthermore, al-Bīrūnī's attitude to former scientists and their schools, as well as to religious and philosophical traditions, differs quite markedly from that of Ibn al-Haytham who shows himself impressed by hardly anyone besides Aristotle and Ptolemy, and even in regard to them grows increasingly independent Al-Bīrūnī, on the contrary, does not hesitate to declare

> "I must assay all aspects of this statement, because I do not refuse to accept the truth from any source, wherever I can find it "[19]

In light of this statement it cannot surprise that his writings abound with quotations from and references to the works of other scholars However, he does not adhere to one master's school, to the extent to which Ibn al-Haytham always remains an Aristotelian He has words of high praise for al-Rāzī, but he explicitly dissociates himself from the school of this famous Persian physician and philosopher [20] But the many quotations from Plato seem to suggest that he had a definite preference for the Platonic tradition

We saw above how Ibn al-Haytham's strong conviction of truth being only one, inspite of the methodological differences, led him to a new and most fruitful combination of mathematics and physics. Al-Bīrūnī, for his part, keeps the different sciences clearly distinct and he considers it possible and preferable to

pursue them one at a time This might seem to be the natual thing to do, but it does not give consistency to his whole scientific system, as the comparison with that of Ibn al-Haytham shows Take, for instance, his extensive use of mathematical calculations in their application to the physical realities of the universe Infinity appears to be their sole logical termination, nevertheless, al-Bīrūnī draws a certain - or rather uncertain - line somewhere, as a sarcastic remark in his *India* shows

> "We on our part found it already troublesome to enumerate all the seven seas, together with the seven earths, and now this author thinks he can make the subject more easy and pleasant to us by inventing some more earths below those already enumerated by ourselves "[21]

Enumeration and mathematical calculation must come to an end at some point, but where exactly? In view of Ibn al-Haytham's fruitful combination of mathematics and physics, and the later development of science, it must look like a tragic omission in al Bīrūnī's scientific system that he was clearly aware of the problem, but did nothing to solve it satisfactorily Since he does not modify his scientific approach following the admission of physical limits at which man's counting and measuring comes to an end, it must appear as a mere theological or philosophical restriction that for him man's knowledge cannot reach out indefinitely into space and time, but goes only as far as sense perception Thus he approvingly quotes from the followers of the Hindu philosopher Aryabhata

> "It is sufficient for us to know the space which is reached by the solar rays We do not want the space which is not reached by the solar rays, though it be in itself of an enormous extent That which is not reached by the rays is not reached by the perception of the senses, and that which is not reached by perception is not knowable "[22]

And concerning time, al-Bīrūnī himself makes a similar restricting statement

> "We do not know of the conditions of creation, except what is observed in its colossal and minute monuments which were formed over long periods of time, for example, the high mountains which are composed of soft fragments of rocks, of different colors, combined with clay and sand which solidified over their surfaces A thoughtful study of this matter will reveal that the fragments and pebbles are stones which were torn from the mountains by internal splitting and by external collision All those changes are necessarily of long duration, and their causes are of unknown nature "[23]

The last sentence must baffle the critical reader, for it is hard to understand how the great astronomer and scientist al-Bīrūnī can so offhandedly push aside any investigation into the proximate physical causes of such earthly changes as those of erosion The most likely explanation seems to be that his Platonic approach to reality, or his high appreciation of mathematical exactitude that simply could not be found in the sublunar world to the same extent as in the movements of the heavenly spheres, stood in the way, preventing him from aspiring after a complete scientific explanation of all the natural phenomena

It should not be forgotten that al-Bīrūnī's achievements as one of the greatest mathematicians and astronomers of the Middle Ages are so outstanding in themselves that they alone lift him above all his contemporaries But they probably would have been even more fruitful had he not, because of a particular philosophical preconception, been satisfied to merely negatively limit his research to the physically, i e through the rays of the sun, accessible world, and, instead, drawn the positive conclusions for all possible scientific knowledge of our world, after all, Ibn al-Haytham did precisely this, when he realized that even our sense organs are parts of the physical world, and that therefore all human science has to be composed of physics and mathematics, or sense phenomena as matter and mental structures as form [34] By his scientific endeavours man participates in the processes of this world, he does not merely lay his mathematical coordinates over it the work in which al-Bīrūnī seems to have found the greatest pleasure

Surely, al-Bīrūnī was aware of the necessary correlation between the observer's logical and mathematical systems, on the one side, and the dynamic interaction of physical bodies, on the other, but that does not occasion him to engage in any elaborate studies of these dynamic aspects, not even to the extent of laying a firm basis for his own observations and measurements As we saw above, in the case of Ibn al-Haytham it was the inquiry into the nature of light that led him to the discovery of a new scientific method, so extremely fruitful in modern physics, al-Bīrūnī, for his part, was satisfied with the mere question whether light was material or immaterial, and his *Optics* seems to have followed the traditional mathematical line [35]

In addition to light, there were, of course, innumerable other natural phenomena and processes that could have served as stimuli for al-Bīrūnī to make his own, doubtlessly valuable, contribution to physical science, the most likely ones being the physical effects of the heavenly bodies on each other, and especially on all events here on earth But, inspite of his many, most exact astronomical observations and mathematical calculations, carried out with no less effort and vigour in astrology than in astronomy, he merely enumerates the various physical effects of the moon, for instance, on earthly substances and events, almost in the same fashion as Ibn al-Haytham, in the beginning of his *Optics*, reviews the variegated effects of light in our environment However,

we look in vain for a detailed examination based on experiments and a mathematical description of the processes by means of functional correlations Consider, for instance, the following text from his *India*, to which many others from his *Astrology* could be added

> "That the moon has certain effects on moist substances, that they are apparently subject to her influences, that, for instance, increase and decrease in ebb and flow develop periodically and parallel with the moon's phases, all this is well known to the inhabitants of seashores and seafaring people Likewise physicians are well aware that she affects the *humors* of sick people, and that the fever-days revolve parallel with the moon's course Physical scholars know that the life of animals and plants depends upon the moon, and experimentalists know that she influences marrow and brain, eggs and the sediments of wine in casks and jugs, that she excites the minds of people who sleep in full moonlight, and that she affects linen clothes which are exposed to it Peasants know how the moon acts upon fields of cucumbers, melons, cotton, &c , and even make the times for the various kinds of sowing, planting, and grafting, and for the covering of the cattle depend upon the course of the moon Lastly, astronomers know that meteorologic occurrences depend upon the various phases through which the moon passes in her revolutions "[26]

Nobody would deny that this list includes many phenomena that should challenge the curiosity of any scientist, as light did in the case of Ibn al-Haytham A precise casual analysis, based on extended observations and carefully planned experiments, could enable him to give a more exact and detailed description of the processes involved, and with the necessary mathematical functions he could formulate the universal laws that would make the different phases of these processes truly comprehensible But nowhere in al-Bīrūnī's voluminous works do we find traces of such physical investigations They would seem to be the natural prerequisites of his numerous and most intricate astrological calculations, still they do not seem to have ever been made by al-Bīrūnī The question, whether he "believed" in astrology or not, has often been discussed , Sachau's view, namely, that he must have had some belief in it, considering all the material he published on it, might be modified in the sense that he "believed" in it insofar as it gave him plenty of opportunities to practise his mathematical skills, but that he never cared much for the physical effects ascribed to the planets and stars, since he not even cared for the ordinary casual interactions between bodies in the sublunar or supralunar world

By way of conclusion, the comparison between two contemporary scientists can only underscore the importance of methodological choices for the development of science and man's total relationship to his whole physical

nature and the universe around him For, al-Bīrūnī and Ibn al-Haytham can be said to be comparable to each other as are the scholastics of the 14th century, with their highly developed mathematics, with Galileo, the founder of modern physics - i e the difference is one of three centuries if the development of science is considered

NOTES

(1) Crombie, A C , *Robert Grosseteste and the Origins of Experimental Science*, 1100 - 1700 , Oxford, 1953

(2) The reason might be that both men wrote commentaries on the *Almagest*

(3) See al-Bīrūnī *The Book of Instruction in the Elements of the Art of Astrology*, transl by R Ramsay Wright, London, 1934, Preface, II

(4) Ibn al-Haytham was born in 965 A D , cf E Wiedemann "*Ibn al-Haitam, ein arabischer Gelehrter*", in Festschrift J Rosenthal, Leipzig, 1906, p 151

(5) *Ibid*, p 157 (My own translation)

(6) *Ibid*, p 156 f

(7) S Pines "*Ibn al-Haytham's Critique of Ptolemy*", in Actes du Xe Congres internationale d'histoire des sciences, Ithaca, 1962 (Paris, 1964), I, p 547 f

(8) E Wiedemann "*Ibn al Haitam, ein arabischer Gelehrter*", op cit , p 165

(9) Cf E Wiedemann *Theorie des Regenbogens von Ibn al Haitam*, in Aufsatze zur arabischen Wissenschaftsgeschichte, Hildesheim - New York, 1970, Bd II, p 71

(10) Ibn al-Haytham *M (or Qawl) f al-Daw*, nr 2 in Majmu' al-Rasā'il, Hyderabad, 1357 A H (1938), p 2 (My own translation) In this context I would like to thank Prof A I Sabra for most helpful suggestions

(11) See M Schramm *Ibn al-Haytham Weg Zur Physik*, Wiesbaden, 1963

(12) See E Wiedemann *Kleinere Arbeiten von Ibn al Haitam 1 Eine philosophische studie von Ibn al Haitam Uber den Ort*, in Aufsatze, op cit , Bd I, p 525, esp note 1 (by Horten)

(13) E Wiedemann *Ibn al Haitam, ein arabischer Gelehrter*, op cit, p 165

(14) Cf M Meyerhof Al-Bīrūnī, *Das Vorwort zur Drogenkunde des Beruni* ed and transl, Berlin, 1932

(15) E C Sachau *Alberūnī's India*, London, 1910, Delhi, 1964 (Reprint), I, p 160

(16) Al-Bīrūnī *The Determination of the Coordinates of Positions for the Correction of Distances between Cities*, transl by Jamil Ali, Beirut, 1967, p 175, cf p 3

(17) *Ibid*, p 8

(18) *Ibid*, p 2

(19) *Ibid*, p 79

(20) See E Wiedemann *Uber al Bīrūnī und seine Schriften*, in Aufsatze op cit, p 487 (Bd II)

(21) E C Sachau *Alberūnī s India*, op cit, I, p 237

(22) *Ibid*, p 225, cf p 227

(23) Al Bīrūnī *The Determination*, op cit, p 16 f

(24) Cf E Wiedemann *Ibn al Haitam, ein arabischer Gelehrter*, op cit P L£&

(25) Nothing definite can be said, though, because it seems to be lost

(26) E C Sachau *Alberūnī s India*, op cit, I, p 346 f

SOURCE BOOKS OF THE KITĀB AL-ṢAYDANAH OF AL-BĪRŪNĪ

DR RANA M N EHSAN ELAHIE

OF the great many works left by Abū Raiḥān Muḥammad ibn Aḥmed ibn Muḥammad al-Bīrūnī, both in Arabic and in Sanskrit - a precise catalogue whereof has been described as occupying a space of not less than sixty large close-written folios - the *Kitāb al-Ṣaydanah* (or, the *Materia Medica*) is decidedly the last of his masterly efforts He set himself to compile this thesaurus late in his seventies, for he himself says in the preface thereof that he has attained the age of eighty

Al-Bīrūnī was assisted by Abū Hāmid Aḥmad ibn Muḥammad al-Nasha'i who had transcribed for him the names of the various drugs commonly used in those days along with their salient properties The great scholar al-Bīrūnī has duly acknowledged this It is also made known to us that the notes were later appended to the text by al-Bīrūnī himself, sometimes by interpolating and sometimes by superscribing He described the drugs and not only gave etymological explanation of the same, but also supplied equivalents in several other languages which he knew, for example, Greek, Latin, Syriac, Persian, Sanskrit, Sindhi, Turkish, and the dialects of Sughd, Zābulistān Nishāpur, Sīstān, Shīrāz, Ahwaz etc Furthermore he introduced to the reader such other drugs - both botanical, zoological and mineral - as were rare obscure and not usually known to the apothecaries and druggists

With incredible labour, al-Bīrūnī was able to bring to this great work, as in the case of some other of his works, a mind capable of ascending to the most comprehensive, and of descending to the most minute surveys, and of delighting in the verbal criticism, the tedious collation and dry antiquarian research, by which the correct form of the name of every herb or drug was established or illustrated He did not hesitate to cite poetical lines and other commonly accepted sayings of the doctors of philology and literary history, like Abū Ḥanīfah al-Dīnāwarī, Hamzā al-Iṣfahānī, Ibn Durayd, al-Khalīl and Sībawayh This has lent a piquant glory to the grand work

This book, a fair copy of which could not be prepared in the life-time of al-Bīrūnī, was well received, and it soon reaped a rich harvest of publicity

Several manuscript copies were made out from this original codex, and hundreds of copyist's errors naturally crept in In the year 549/1155, Abū al-Maḥāmid Muḥammad ibn Mas'ūd ibn Muḥammad al-Zakī al-Ghaznawī (d 575/1179) chanced upon a MS copy of the work dated as early as Wednesday the 20 *Rabi I*, 468/ the 3 November, 1075 Al-Ghaznawī undertook to collate the various copies available to him and prepared a fresh copy, and entered a number of marginal notes Though in the meantime, as it seems, the earlier MS copies were lost, yet the usefulness of the *Ṣaydanah of* al-Bīrūnī remained uneclipsed About a century later, Ibrāhīm ibn Muḥammad ibn Ibrāhīm al-Ṭabrīzī known as Ghaḍanfar (d 692/1293) made for himself another transcript of Al-Ghaznawī's copy This was accomplished in the later part of the year 678/1280

Now the only known copy of the *Kitāb al-Ṣaydanah* of al-Bīrūnī is the one in the handwriting of Ghaḍanfar al-Ṭabrīzī (who has also incidentally made the unique copy of the *Tatimmah ṣiwan al ḥikmah* and the *Itmām*, now preserved in the British Museum), and is lying in one of the libraries of Istanbul Unfortunately this valuable copy of the *Ṣaydanah* is waterstained, lacks the virtue of legibility and suffers from sporadic lacuna Moreover the queer and cursive handwriting of Ghaḍanfar is not easily decipherable

Prof Max Meyerhof, the eye-specialist, obtained a photographed copy of the Istanbul MS and issued the first 15 folios of the work in 1932 In May 1935, 'Abd al-Razzāq al-Baghdādī prepared a handwritten copy for the Oriental Library (=Al-Maktabat al-sharqiyah) of Baghdad A little later a copyist at the Royal Egyptian Library, Maḥmūd Sidqī by name, made another transcript from the photocopy of Prof Max Meyerhof This was completed on 26 *Dhū al-Ḥijjah* 1354/20 March 1936, and is now preserved in the Cairo Library

The Hamdard National Foundation, Pakistan, while celebrating the Millenary of al-Bīrūnī, is presenting an humble attempt of this unpretentious student in the form of a critical edition of the *Kitāb al-Ṣaydanah* along with an English translation of the whole work by the able and gifted Hakim Mohammed Said

Unlike the *Kitāb al-mujarrabāt* of one Ibn Zuhr of the 7th/13th century (a unique copy in the private collection of the late M Muḥammad Shafī', Lahore), which is saturated with superstitions and occult properties of the drugs, the material of the *Kitāb al-Ṣaydanah* of al-Bīrūnī is by far reliable and authentic Curiosity as well as duty had led al-Bīrūnī carefully to examine all the original works that could illustrate the subject which he had undertaken to treat With the characteristic ardour of learning, scientific research, after exhausting all the sources in Arabic, Persian, Syriac and Sanskrit that he could lay his hand upon, he completed this work Singularly free from bigotry, he was ready to derive information even from the writings of infidel Hindus or a Christian monk The *Kitāb al-Ṣaydanah* is however the amplest herbal canvas

ever spread, the largest apothecaric painting ever executed, and only a comprehensive and orderly intellect of the highest rank could have welded the massive and incongruous materials into such a unity of design

Throughout the book the author's vast and miscellaneous reading, which included the Arabic translations of Hippocrates, Galen, Dioscorides, Oribasius, Aetios, Paulus Aegineta and other Greek writers is mingled with his original observations He had almost all the *Karanish* (sing *kunnash*) under his elbow, e g the chief ones being those of Oribasius, Paulus with glosses thereon by Abū al-Khayr, Jibra'īl ibn Bakhtishū, Hunayn ibn Isḥāq, Ibn Mandawayh, al-Amidī, and others He consulted the great al-Rāzī (his *al-Hāwī*, *kitāb al-abdāl*, *kitāb al-aghdhiah*, and even his *kitāb al-Ṣaydanah*) The *Ṣaydanah* of Galen also passed his notice Of the oft-quoted authorities are Ibn Māsarjawayh, Ibn Māsawayh, Ibn Masā, Abū Mu'āḏh, Suḥārbakht, Abū al-'Abbās al-Khushki, Abū Zayd Al-Arrajānī, and Miskawayh For the equivalents in Sanskrit of Hindi and Sindhi, he mainly relied on Bishr and Muḥammad ibn Ibrāhīm al-Fazārī One Saṣard al-Hindī is also one of his chief authorities And more often than not, he gives us the benefit of his personal observations

That al-Birūni did not hail from Sind is amply to be borne out from the study of this *kitāb al-Ṣaydanah* Al-Bīrūnī is parsimonious in supplying equivalents in Sindhi language of even the most commonly used drugs The Sindhi names of herbs and drugs are so meagre in number especially in proportion to those of other languages like Sanskrit and Persian, that one is constrained to believe that al-Bīrūnī had little knowledge of Sindhi On the other hand, he relishes in enumerating the various species of fruits and herbs, and in deluging the book with their parallel names in the various cognate dialects of Khurāsān, like those of Sughd, Jurjān, Zābulistān, Nishīpūr, Sijistān, and Zukhd Above all, as in several of his other books, he mentions دراهمنا " and دينارنا (= our dirhams and our dinars)

Of the kind and amount of varied ability displayed in this truly immortal work, it would be almost impossible to speak in language of exaggerated praise - the grandeur and vastness of conception, the artistic grouping, the methodical arrangement, the masterly fullness and accuracy of detail, the richness and vividness of description, punctuated with his coruscating observations

While thus entitled to great and manifold praise, the *kitāb al-Ṣaydanah* cannot be exempt from a certain measure of just criticism It is very likely that al Bīrūnī could not find an opportunity to revise this work Even when the occasional grammatical absurdities pointed out by the industry of critics have been willingly overlooked, there yet remains something to be said on the defects of the style Precise, energetic and massive it is, splendid when the pictorial demands of the narrative require it as that of Ābnūs, Tūt, Chāy etc , and sometimes, when profound reflections are to be concisely expressed, as sententious

and graphic as that of طرار But with all its great merits it is sometimes formal In a work of such extent it is a venial fault that the worksmanship should not in all parts be equally perfect That al-Bīrūnī has failed at certain places in that lucidity of statement which is one of his very strongest characteristics has been noticed For example, al-Bīrūnī is out of harmony with the truth, when he describes the Timsah (crocodilia, an amphibian and oviparious animal) which deposits its eggs in holes made in the sand or mud of the river-side, where they are left to be hatched by the heat of the sun On quitting the egg the young crocodiles are led to the water by the female parent, but to our surprise, these young ones, as al-Bīrūnī further describes, who creep on towards the desertside assume the form of a lizard (lacerta)

COMMENTS ON TAHDĪD NIHAYAH AL-AMĀKIN LI TAṢḤĪḤ MASĀFAH AL-MASĀKIN

INAMULLAH JAN

THE original book of *Tahdīd Nihāyah al-Amākin Li Taṣḥīḥ Masāfah al-Masākin* written by Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī was completed on 27th Rajab 416 A H (1025 A D) at Ghaznah It contained 100 pages [1]

Tahdīd is divided into three main parts

1 Preface In the preface al-Bīrūnī has given a long introduction, devoted to the nature of the growth of the different branches of knowledge, methodology adopted for research, difficulty in understanding the history of the creation of the earth and man, geographical and geological features of the earth and the aims and objects of the book

2 The second part of the book starts with the real subject matter In this part the method of finding out the correct latitude is explained, the bend of the earth on its axis, the latitude with reference to the axis, the understanding of either the latitude or the bend of the earth derived from the knowledge of any one of these two, the longitude between the two countries, the measurement of the distances based on longitudes and latitudes and the measurement of the circumference of the earth

3 Part third is devoted to the longitudes and latitudes of the different countries The book is concluded by some astronomical observations of the other scholars

Growth of the branches of knowledge and causes responsible for writing the book

Al-Bīrūnī has written a long discourse about the causes responsible for writing the book on geography with specific emphasis on the latitudes and longitudes In the preface he has not made himself limited to the utility of the geographical knowledge only but has mentioned about the utility of mathematics,

medical science, poetry, music, astronomy, logic and grammar He has based the pursuit of knowledge on the man being civilised and facing so many challenges in life Man has adopted various professions for the sake of skill and perfection (p 6) Mathematics is said to be essential for counting and keeping records Medical knowledge for curing the diseases both in men and animals, poetry and music for catharsis and enjoyment, astronomy for knowing the impact of stars, sun, and the moon, on human life, and logic and grammar for finding out the truth and correction of the speech

Regarding the necessity of the geographical knowledge he mentions, "One day I was sitting with some scholars who opened the discussion about a book named *al Masālik wal Mamālik* (Routes and Kingdoms) (p 10) Some criticised the idea that geographical knowledge was of little use to man I thought that these people know little about the utility of a very important science Geography for a business man is as important as grammar for the speaking of a language Moreover, the true knowledge of geography is very essential for a Muslim for knowing the right direction of Mecca Allah has also asked us to travel on the earth and see the fate of ancient people"[2] Al-Bīrūnī has also mentioned that Muslims not only needed the knowledge of geography for business contacts and travelling purposes, but they needed it for finding the right routes during the holy war and pilgrimage He has made special emphasis on learning the science of geography for the true direction of Mecca

Methodology Adopted

Al-Bīrūnī opens his book from the word of Aql, the rational faculty of man He says "Human reason needs data and no human being can be an exception from the need of Phenomena in which the mind functions" (p 3)

"I observed around myself that people were just ignorant of the knowledge and significance of the physical universe Their knowledge was shallow and they would go down to the mean position of sticking to their false arguments These people were of the opinion that man's chief objective in life was to obtain happiness and avoid pain (pp 4, 5) Such people do not know the reality of the Qur'anic verse "They ponder over the creation of the skies and the earth saying that the Creator has not created them meaningless"

By such beginning al-Bīrūnī emphasises the significance of thinking, reasoning, and reaching fruitful conclusions

Al-Bīrūnī has further elucidated his method of research that he does not follow blindly the traditional lore just like other pseudo-scholars do, but he collects all the available data, analyses it, and then reaches certain results He has referred to the following verse of the Holy Qur'ān "Can those persons who know be compared with those who do not know, without doubt the owners

of reason can obtain the true consciousness " Al-Bīrūnī studies the minute details of a subject for reaching the correct conclusions It is this scientific attitude of his that makes him a modern scientist Keeping in view the approach of al-Bīrūnī, Mr Arthur Upham Pope in his article "*Al Bīrūnī as a Thinker,*" points out like a true scientist, al-Bīrūnī insists on the necessity of observation and experiment and is scornful of those who uncritically merely repeat tradition" (p 283). Again Pope cites 'Al-Bīrūnī in accord with modern philosophical and mathematical procedure tests the truth of assertions by first developing their implications, then testing these implications for consistency and reasonableness "

Concepts about Creation and Time

Al-Bīrūnī is sure that it is humanly impossible to understand the problem of the creation of the universe, because man cannot understand a thing unless he knows its history He says that our knowledge is purely speculative in this respect

1 A body is the creation of the succession of the changes

2 Anything that is the creation of the changes is destructible

3 Therefore, a body is destructible and not eternal

So when the body is destructible the changes must also have started in a time limited, therefore, time is also limited and vanishing

Past is one of the fragments of time, which being limited and changeable can be counted and increased Therefore every being has started appearing in a specific period of time and would remain existing to a specific period of time

And time can only be hypothetical (pp 17, 18)

In support of his own ideas al-Bīrūnī has borrowed extracts from the revealed books He says "So far as the owners of the books like Jews, Christians, Sabians, and Parsis they all agree on the creation of the first man, with disagreement only on the matter of time scale In the book of Torah it is mentioned "In the beginning the land was barren and the wind of God was blowing on the surface of the water " For this reason the Jews thought that this period was the first day of the week of the creation of the universe This period could not be measured in the time scale of our days and nights The chief defect in the time of our day and night is that these are the creation of the sun and the moon, which were brought into being on the fourth day of the week of the creation Such a day is in one place mentioned in the Holy Qur'ān as of a thousand years and in another place of fifty thousand years (pp 18, 19)

Al-Bīrūnī reinforces the argument of Torah by mentioning the verse of Qur'ān in respect of the beginning of human life on the earth from air and water, "And the throne of Allah was on the water "

Physical Features of the Earth

Al-Bīrūnī is sure that we can never be able to know about the creation of man and earth So far as the existence of the earth is concerned we find that the high mountains produced the gravels of various colours, which gradually turned into sand by the effect of water and air Consequently the earth dust came into being, which covered the surface of the earth. Gradually the effects of heat and cold changed the face of the earth With the change of the weight of the earth towards its centre the water appeared in the shape of springs, which while flowing towards the slope turned into lakes and rivers Human population grew round the water

With the passage of time such waters disappeared and along with it the deserted villages and cities were buried in the earth (pp 19, 20)

Abū al-'Abbās Irānshahrī mentions about a buried fort named Bida, a few miles away from Sayrjān in the country of Kermān, which came to light when the people discovered the roots of the date palms there

In the deserts of Arabia once a big river was flowing Much after the disappearance of the river the people found bed of earth and ashes containing pottery, glass and bones (p 21)

Al-Bīrūnī says that such discoveries were made in Jurjān and Khwārizm— even Ptolemy has mentioned about the river of Jurjān, who happened to be 800 years before us

Ibn al 'Amīd has mentioned in *Binā' al-Madan* that an earthquake in Ruyan caused two mountains to collide, it stopped the water which was flowing in the valley and thus a big lake came into being Such is the example of the like in Urdun (p 23)

It has been proved in the knowledge of astronomy that the earth is round, therefore, its gravity remains towards the centre from every side Water also sticks to it because of gravitational pull, only it rises above its surface to the tone of waves

So we know from the observation that the earth remains under the water The flow of water from the height is due to the pressure of the air, and its penetration in the dust of earth is natural

Al-Bīrūnī quotes the Qur'ān, that on the day of the creation of man the Throne of Allah was on the surface of the water, so when Allah determined to create the living beings, He removed water from a portion of the earth by making the water flow down the slopes The sun was subjected to get water evaporated, and the moon to raise stormy waves in it The evaporated water became sweet, which came down to the earth, flowed in the shape of streams and rivers, and made human habitation possible The stormy waves in the sea kept the water in movement and did not allow it to be rotten (p. 27)

The sun and the moon were subjected for ever by Allah for the service of the humanity The earth is divided into extreme hot regions and extreme cold regions Most of the human population live in the temperate zones, which make the centre of the earth, where there is the abundance of water and hence of vegetation, on which the human habitation depends

Regarding the other side of the globe, al-Bīrūnī says "In case on the other side of the pole there is land like that of ours, which contains the same qualities like our pole, then it is essential that it would be having the air like we have got and hence all other things, which we have on this side of the globe" (p 28)

One of the chief features of *Tahdīd* is that al-Bīrūnī has given almost the accurate measurement of the circumference of the earth in it At the Fort of Nandana, Jhelum district of Pakistan, he found a proper place for such measurement A high cliff surrounded by a large flat area were the chief requirements for such an experiment (p 212)

Conclusion

Tahdīd enjoys a great place in world geographical literature

1 *Tahdīd* is the first book of geography devoted to one specific topic of astronomical and mathematical geography (longitudes and latitudes) But the idea of specialisation in different fields of geography is the development of the 20th century Hence al-Bīrūnī was one thousand years ahead of his time in the field of geographical science

2 The method of preparing model maps is also of recent origin But al-Bīrūnī has made the model map of the earth long ago He has divided the surface of the earth into seven well defined regions with Babylonia, 'Irāq, Irān, Khorāsān, Sajistān, Zablistān, Tukhāristān, Naṣṣibain, and Azarbaijān in the centre making one region

3 Al-Bīrūnī is the first geographer who has dealt in detail with the subject of sedimentology and has accurately speculated that the land making the present Indus region was once a great sea, which was gradually filled by the gravel falling down from Himalaya The preface to *Tahdīd* deals a great deal with sedimentology

4 Al-Bīrūnī is one of the rare geniuses who has speculated in *Tahdīd* about another world on the other side of the globe

5 By his accurate mathematical and geographical knowledge, al-Bīrūnī has bettered the measurement of the earth The geometrical patterns in *Taḥdīd* speak for his keenness in the field of measurement.

6 *Tahdīd* also sheds a great deal of light on the human geography and man is shown by al-Bīrūnī as subservient to his environment He has referred to some of the old sites of human habitation which had been abandoned due to the disappearance of water He has opened the avenue of the science of geographical changes, which is a beacon for modern archaeologists

7 Romans were the first who felt the need of knowing the distance between the different countries for administrative purposes Al-Bīrūnī made it a complete science, and thus opened a new branch of knowledge of the science of communication, which plays a great role in the development of the culture and civilization

8 Al-Bīrūnī's approach is thoroughly academic, rational and free of prejudices He goes from observation to observation for finding out the true results which is the modern method in the field of scientific studies

9 According to Syed Hossein Naṣr, *Tahdīd* is one of the rare works in the history of Muslim science, and by writing this book al-Bīrūnī has become the founder of the measurement of the earth

Keeping in view the scientific researches of al-Bīrūnī one can conclude that the mediaeval period of Europe was far backward than the Muslims of that period The Muslim world was thoroughly enlightened at that period just like we find the world of today guided by science and experimentation Therefore, world history has to be rewritten in the light of the contributions of the Muslims specially in the domain of sciences In case of the reappraisal of the scientific literature produced by the Muslims may be we find new foundations for the development of the sciences

REFERENCES

1 The original manuscript is preserved in Turkey in the library of Sulṭān Muḥammad Fātiḥ The present book which I have used for references is the revised version of Muḥammad bin Taawit al-Tanjī, published from Ankara in 1962 by Dogus Ltd in Sirketa Matbassı Press

2 Al-Nahal-36 Faater-44

3 Al 'Imrān, p 191

4 P 284 (Commemoration Volume, Iran Society, 156 B, Dharamtala Street, Calcutta)

INTERPRETING AL-BĪRŪNĪ'S OBSERVATIONS ON INDIAN ALCHEMY

DR S MAHDIHASSAN

SIR P C Ray[1] has written a classical work entitled, "*History of Hindu Chemistry*" There the only authority cited, pertaining to Indian alchemy of about 1000 A D, is al-Bīrūnī, who lived in India from 1017 - 1030 A D Sachau[2] has translated "*Alberuni's India*", further adding many illuminating notes of his own If we take al-Bīrūnī's account as representing the present, any present is best appreciated in the light of its past Thus our problem is shifted to the subject being taken as far back as possible Accordingly we may briefly recapitulate the history of medicine for many of its past features have continued to persist and have to be recognized

Man first began to cure himself by means of prayers and enchantments using no drug whatsoever This was also the stage when man resorted to magic when by mere curses he could harm his enemy Later came "herbal-magic" and at the same time herbal-medicine Plants were supposed to harbour spirits good and bad Those transferring evil spirits were used for black magic and a regular system of herbal magic developed out of it On the other hand plants carrying benevolent spirits were able to cure diseases by mere physical contact Herbs were used now as amulets or charms Just as a magnet by mere physical contact can magnetize a piece of iron some herbs were supposed to similarly cure diseases by physically transferring their "vital force" or soul It was like charging a battery that was being exhausted Later on plants were chewed, or taken as powder, or above all as extract or decoction Here begins herbalism proper with the active principle being assimilated But the active principle still remained purely spiritual in nature and only gradually gave in to a material one Nevertheless at no stage the spiritual power of plants was entirely overlooked Here we must recall that as late as the last century scientists spoke of "vital force" as the active principle of medicaments This was only a disguised term for soul If the primitive man believed that the spirit donated by a plant cured him, the modern man would say instead that it was the vital force it contained In this connection I know of a famous drug house manufacturing eastern medicines maintaining that "the strength of the medicament passes into the system of the consumer" And on what does such a strength depend, which unchanged, can be transferred from a drug to man. Here

we must realize that we still use for distillate of rose, the term, *Ruh-e-gulab*, or the soul of rose flowers In English the distillate from wine is correspondingly called "spirit of wine" Only when we recognize that the therapeutic agent was nothing short of soul can we understand theoretical medicine of the past and the same applies to theoretical alchemy which is a specialized form of medicine

As a supplementary approach to the subject we wish to know how medicaments were classified in the past The earliest authority on codified Indian medicine is Charaka[3] who lived about 200 A D By now his works have been edited and translated into five thick volumes in India Sir P C Ray (1, 73) correctly explains that, "Charaka classes medicines under two main heads One increases strength and the vitality of people already healthy (by) Vital Elixir, the other cures diseases The former promotes longevity and vitality and is called Rasayana" This division is unique in so far as rejuvenation, which is impossible, is given priority over treatment of diseases However when we consult Charaka's works he does use the word Rasayana precisely for rejuvenation It is no word for geriatrics as we understand it Nor is Rasayana an aphrodisiac for which he uses the term Vajikarana with which we are not concerned Now the only other country, where people believed in regaining eternal youth by means of drugs, is China, and alchemy arose from China as an improvement upon the art of rejuvenation Seeing that Charaka assigns priority to vitalizing drugs or Rasayana over medicines the question arises as to the origin of this emphasis on his part

According to Virchow[4] "medicine is a social science in its very bone and marrow" And I can add that the same applies to alchemy We are then taken back to ancient times when struggle for life was most severe Man lived in a community and was bound to hunt together, fell forest trees and even partake in feudal attacks The aged were ill suited for such strenuous work and were felt as parasites and consequently excommunicated They had to live as solitary denizens of forest Thus arose asceticism confined to old age as an inevitable social curse Now the first problem for the ascetic was to overcome shock The Aryan ascetic took to *soma* or Ephedra as an energizer Later on, at present, *bhang* or Cannabis indica became the favourite drug Thus the history of asceticism begins with drug addiction This explains how the Aryan ascetic could extol *soma* in his hymns

The next need of the aged exile was to keep himself fit enough to collect his ration in the form of vegetables, roots and wild fruits A day's rest meant fasting and a prolonged sick-leave, death from starvation He yearned for the good old days when he was young and dreamt of a drug that could recall the strength of his youth We may even say that he continued to live as a solitary old man merely on the hopes of discovering a remedy against old age And once rejuvenation became possible the recurring use of the drug could confer eternal youth and man would become immune to natural death As the ascetic's contribution practically all religions have come to accept that in post-mortem life

those who enter heaven would do so definitely as young people We can therefore rightly equate rejuvenation with immortality, assigning priority to the conception of rejuvenation Here we must also differentiate between drugs mentioned in legends from those taken seriously by practising physicians In India there was the fabulous drug *amritha,* while in Greece it was *ambrosia* But Charaka has no recipe for *amritha,* nor does Hippocrates deal with *ambrosia* Incidentally it may be mentioned that both the words *amritha* and *ambrosia* have a common Aryan root Even the Assyrians believed in a tree of life and others in spring of life or in life-giving and rejuvenating waters The conception of rejuvenation by other agencies than by assimilable drugs is even older

Focusing our attention on the need for the aged ascetic we can appreciate his eagerness to discover rejuvenating drugs He ransacked the resources of the forest, herbal and mineral, hoping at least to keep himself strong enough to be able to function as his own cook and his own nurse By such a search he incidentally discovered the properties of so many medicinal plants that it is no exaggeration to affirm that the ancient pharmacopoeia of India, as also of China, were founded by their ascetics Only now we can realize how the founder has left his stamp on medicine and classified drugs, one as conferring rejuvenation and the other as merely curing ailments Charaka's two sub-divisions with emphasis on Rasayana can now be easily appreciated as the legitimate inheritance from the past

Inasmuch as Charaka as a physician did believe in rejuvenation he gives several recipes including a few of his own Above all he reproduces a formula developed and tried upon himself by a sage named Cyavana About him we are further told that the sage, "though grown very old became young once again by its use" The preparation is named after him as "Cyavana-Prasa" Linctus It comprizes a number of ingredients, all herbal Among them the foremost is *amla* (Phyllanthus emblica) a wild fruit which is the richest natural source of ascorbic acid It has reducing properties and is therefore an excellent anti-oxidant In Cyavana's recipe next comes *harr* or myrobalan, which is rich in tannins and these again are reducing agents We can therefore maintain that Cyavana-Prasa is an anti-oxidant and we also know otherwise that old age is prone to excessive oxidative processes Here I cannot help referring to the latest work on longevity The American scientist, Prof Harmann[5] of Nebraska, has found that oil soluble anti-oxidants considerably increased the life-span of mice, although he also found that Vitamin C had no such effect Nevertheless the recipes given by Charaka can be properly classed as anti-oxidants Having found in Charaka the mention of *amla,* as the most important drug, and myrobalan as next to it, we now turn to what al-Bīrūnī (2 318) has to say He speaks of an Indian preparation called "Raktamala as constituted of myrobalans but when used had no effect" We must not be surprised to hear of such disappointing reports for we realize first that rejuvenation is impossible and also that such a belief was nevertheless cherished by a pitiably old exile On al-Bīrūnī's Raktamala, Sachau (2, 318) observes that, the word is derived from Rakta = Red or Blood, and

amla=Emblica officinalis, now Phyllanthus emblica Very probably Raktamala, like Cyavana Prasa, contained both *amla* and *harr* or myrobalans, whereas al-Bīrūnī refers only to myrobalan, Sachau rightly explains *amla* as its more important ingredient.

When we go further and further back into the past the best evidence remains as internal evidence It means that when Rasayana became the drug of rejuvenation the word was coined having such a connotation We are therefore required to translate the word Rasayana properly Since the Greeks never knew of a drug of rejuvenation, Rasayana cannot be identified with any word of Greek or Latin origin Accordingly when Monier-Williams[6] came to compile his Sanskrit dictionary he translated Rasayana = Elixir and could merely paraphrase it as a drug "giving long life" Now the word Elixir is Chinese in origin This requires briefly handling its etymology We remember that in ancient time the active principle of medicinal plants was soul We can further grant that a soul that could transform old age into youth must be the best of its kind or the-one-soul of which there could be no equal Now the word for soul in Chinese in Ch'i But there is also the term Ik-Chi,' meaning "the one soul" This word was Arabicized as Iksi-(R) and has been discussed before[7] The Chinese, like the Indians, believed in drugs of rejuvenation and the Chinese term for the active principle of such drugs was Ik-Ch'i or Elixir as we finally have it It is for this reason that the Sanskrit word, Rasayana, can be translated only by the Chinese term, Elixir

To confirm this we have now to independently handle the genesis of the word Rasayana The explanation Ray[1] offers in this connection is to translate Rasa = Mercury, which is its much later and secondary meaning Next Ayana = Way or method This makes Rasayana = Way of Mercury, the method of dealing with mercury, or the know-how of mercury Such an etymology was invented to explain that Rasayana was concerned with making gold, starting with mercury, and as such Rasayana is the Sanskrit word for alchemy We now turn to what al-Bīrūnī has to report on Indian Rasayana Al-Bīrūnī as a Muslim knew alchemy by its later and degenerated form concerned with the synthesis of gold, from metals like mercury or copper Such an alchemy he did not find in India Accordingly he writes (2,187) that, "the Hindus do not pay particular attention to alchemy (But) they have a science similar to alchemy which is quite peculiar to them They call it Rasayana a word composed with Rasa i e gold (p 188) It means an art which is restricted to certain compound medicines most of which are taken from plants Its principles restore the health of those who were ill beyond hope and gave back youth to fading old age, so that people became again what they were in the age of puberty regarding the capacity for juvenile agility and even for cohabitation" Nothing could be said more clearly to confirm that Rasayana was the art of rejuvenation and Rasayana as the drug aimed first at rejuvenation and next at longevity which it naturally implies Such was Indian Rasayana at about 1000 A D and is identical with that of Charaka flourishing at about 200 A.D

We have further to explain al-Bīrūnī equating Rasa=Gold This shifts our problem to handle the conception of gold as existing in the remotest past. Chinese have a very ancient past and retain many neolithic ideas. In Chinese there is no special word for gold Kim is a dialectic word for gold but really speaking it merely signifies metal Thus what was later conceived as "the metal" or the one-metal, became gold Gold did exist in China but in early days no therapeutic value was attached to it However, later on, gold was used as amulet or allowed to remain in contact with the body We have discussed before, that some herbs could transfer their active principle or soul by mere physical contact. Gold acted accordingly Still later gold was taken internally comparable with herbs This is best understood on realizing that man found gold as the only substance which was everlasting Since animism existed in those days it was logical to believe that gold also carries a soul and this soul makes gold everlasting and accordingly can make man immortal on his imbibing the active principle of gold In this light gold=donor of an immortalizing soul And if al-Bīrūnī equates Rasa=Gold we have to expand adding Gold=Soul Thus Rasa=Gold=Soul We would now be required to independently confirm that Rasa=Gold as al-Bīrūnī informs and also Rasa=Soul without which al-Bīrūnī's equation cannot be understood

We first take up the more important equation Rasa=Gold Gossain's[8] Bengali dictionary translates Rasa=Swanna=Gold This offers the documentation that was badly missing so far I cannot help observing that no notice has been taken so far of al-Bīrūnī's bold equation that Rasa means gold Some would be misled to believe that, with such an etymology of Rasayana, this becomes the "way to gold" or the "know-how of gold making" On the contrary gold was something dead This was the view of the alchemist who instead wanted live-gold, bubbling with life, which alone could donate an everlasting essence Dead gold had first to be resurrected, and enlivened gold alone would be fit as drug Such was synthetic gold, or fresh gold, as opposed to metallic gold or fossil gold And the resurrecting principle or the enlivening agent came from living plants Hence gold was calcined with herbs when according to theoretical alchemy the soul of the plant was transferred into the metal and gold now became a living agent We see now clear enough that metallic gold as a drug of immortality was very weak, whereas synthetic gold was very potent That is why the alchemist wanted to make gold He first enlivened metallic gold and next proceeded with other base metals, making them likewise vehicles of an everlasting soul, and this was impossible unless they themselves became gold and then live gold By now we are in a better position to confirm that Rasa=Gold, since Gold=Soul We are now left with the equation Rasa = Soul A Sanskrit-Bengali dictionary, Amaratha - Chandrika[9] translates Rasa = Pran, when Pran = Life-essence or soul Then directly translated into English, Rasa=Soul Our discussions would be considerably reduced on comparing the origins of the two words Rasayana of Sanskrit and Kimiya of Sino-Arabic Rasa is primarily Juice, secondarily Soul, and thirdly Gold Thus Rasa=Juice = Soul = Gold

In Kimiya, Kim = Gold and Iya = Juice, exactly as the Sanskrit Rasa Accordingly Kimiya = Gold-making juice Then the juice-made-gold is gold to look at, but juice - incorporate, virtually soul - incorporate, something living

But it was some juice rich in ascorbic acid which, ground with yellow gold, turned it into red-gold, or colloidal gold The change was so radical that it was interpreted as bloodless yellow metal having come into full life with a blooming reddish appearance as red gold The juice was looked upon as donating its soul to the metal, for there can be no active principle that can resurrect, be it a metal, other than soul And if the soul can resurrect one metal it can do the same with others And since the soul confers eternal life, even other metals, accepting the same, must necessarily become everlasting or gold We see here that synthesis of gold is merely extending immortality to base metals Rasayana is not so explicit in its etymology but merely implicit With Rasa=Juice, Rasayana becomes Vehicle of Juice, juice separated from some plant and transferred into some other vehicle, be it a metal The accepting metal would also become juice-incorporate When Rasa=Soul, its receiver would now be Soul-incorporate, with soul as the active principle This would be a general agent to resurrect anything dead, as also to rejuvenate any one decrepit When Rasa = gold, gold itself represents the soul of an everlasting metal, so that the above significance holds again The words Rasayana and Kimiya have identical roots for Rasa = Iya = Juice, and Juice = Soul in herbal magic Rasayana would be vehicle of soul, or Soul - incorporate, and Kimiya as gold-making juice would be juice as soul conferring everlasting life or immortality Thus from the study of comparative alchemy we recognize it as being concerned with drugs of rejuvenation-cum-immortality From comparative etymology we further confirm that Rasayana of India and Kim - Iya of China are terms for substances conferring immortality

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AL-BĪRŪNĪ AND HIS KITĀB AL-JAMĀHIR FĪ-MA'RIFAH AL-JAWĀHIR:

Ethical Reflections and Moral Philosophy

DR SYED H H NADVI

THE School of Baghdad survived the political downfall of the Caliphate The creative activity of Baghdad although slowed down, did not cease completely until the middle of the XVth Century Asia, India and China were influenced by the Baghdad School Abū Raiḥān al-Bīrūnī (b 3, Dhū al-Hijjah 362/4 September 973 - d 2 Rajab 440/13 December 1948),[1] served as living link between the traditions of the School of Baghdad and those of India He enjoyed the patronage of the Court of Mahmūd of Ghaznah (997 - 1030 A D)

Kitāb al-Jamāhir reveals a three-dimensional personality of al-Bīrūnī, namely (1) al-Bīrūnī as a teacher of ethics or moral philosophy, (2) as scholar of mineralogy and as expert of precious stones, known in Arabic or in other languages, and (3) as an evaluator of precious stones and the inter-relationship between precious stones and coins[2]

Ethics of al-Bīrūnī

Each discipline of thought has its own code of ethics A lawyer, a physician or a teacher is supposed to be honest in his profession Thus honesty is a part of ethics No religion is without ethical commandments "Thou shall not kill" or "Do unto others as you would have them do unto you" Daily life is also governed by ethical notions which vary, of course, according to the belief system of the community such as, "The end justifies the means", "Might makes right", "Every man for himself", "My country, right or wrong", "Good neighbour policy", "Fair play", or "Taking arms against aggressor is always right course of action", and so on Reaching a decision, as to what choice among alternative courses of conduct one ought to make, is precisely speaking the subject matter of ethics or moral philosophy Ethics is concerned with the understanding of what is meant by such terms as "good", "right", "justifiable", "duty", "responsibility" and so on in forming judgement about how people ought to behave when confronted with a choice of alternative

Value judgement is, therefore, implicit in ethics It is difficult for all intelligent persons to agree on ethical terms, such as what is right and what is

wrong, especially when their own interests and beliefs are different The great moral teachers of mankind have devoted their lives to reach a conclusion about a way of good life, about a concept of good and bad, right and wrong Thinking persons or moral philosophers like Confucius, Laotze, Buddha, Zoroaster, Socrates, Epicurus, Epictetus, Spinoza, Kant and Dewey spent their lives in searching answers to ethical problems[3] In western as well as in eastern civilisations conflicting ethical ideals are quite evident Worldliness of Classical and Renaissance cultures was opposed to unworldliness of medieval and mystic renunciation of all earthly desires The Catholic ethics of Aquinas and the Protestant ethics of Kant, the evolutionary ethics of social reform and the revolutionary ethics of violent seizure of power are two different ideals diametrically opposed to each other Socrates' theory that "Virtue is knowledge" was contradicted by the Romantic slogan "Ignorance is bliss", for ignorance keeps men happier Similar is the conflict between established traditions and changing social conditions The accepted or socially sanctioned standards of good and bad are not one and the same Ethical reflections are yet in the process of revealing the philosophy of common morality, acceptable to all religions and civilisations Since ethical principles are involved in making a choice between alternative possibilities in terms of better and worse, it is the aim of moral philosophy to clarify ethical choice A "good person" or a "good character" is the product of good beliefs, good breeding, good habits, good education and good religious training There are many different opinions about what is good in regard to character, breeding, habits, education and religion Discussing the stable set of habits for the formation of character, Aristotle in the first chapter of his *Ethics* notes that a young person, ruled by uncontrolled impulses, was not yet ready for the study of ethics The term "young" does not imply youthfulness in years but in maturity of habits of self-control and of reflections over one's experiences

Now coming back to the first part of the *Kitāb al-Jawāhir*, namely the fifteen *Tarwīhahs* with preceding and succeeding chapters,[4] we can see his treatment of good, bad, happiness, moral excellence etc The moral philosophy and ethical reflections of al-Bīrūnī revolve around his theories of virtue (*al-Murū'ah*) and perfection (*al-Futuwwah*) These concepts are evolved in various ways in his different *Tarwīhahs* or parts of preamble The whole philosophy is religious in character rather than abstract rationalisation like those of philosophers He deals with the spiritual life of man, his virtues and evils affecting the conduct of man and society His moral philosophy derives its inspiration from the Qur'ān and Sunnah, so frequently quoted in support of his statements and arguments

Before opening his discourse on ethics, he initiates it with praise of God who created the universe, skies, sun, and moon for the benefit of man and sent down rain to raise his subsistence He concludes it with the praise of the Prophet[5]

In the first *Tarwīḥah*, al-Bīrūnī discusses the five senses of man, so vital for his existence and initial perceptions of Truth They were, no doubt, blessings of God [6] The second *Tarwīhah* deals with the senses of man and of animal and describes the superiority of the former over the latter Animals were created for the service of man, so that man could be grateful to his Creator The following verse has been cited in favour of the argument

أولم يروا انا خلقنا لهم مما عملت ايدينا انعاماً فهم لها مالكون و ذللنا ها لهم فمنها ركوبهم
ومنها يأكلون ولهم فيها منافع ومشارب افلا يشكرون -

Mentioning the benefits of the senses of seeing and hearing (السمع و البصر) he says that man was endowed with these senses so that he could recognise signs of God and listen to His commandments The importance of such vital senses can be realised only after their loss He concludes that these senses served as major sources of knowledge His entire efforts seem to prove the existence of God and His flawless creations for the benefit of man, so that he could lay the foundation of his ethics on revelation rather than on rationalism and invite men to follow the divinely revealed ethics and not an ethics related to human ambitions He cites the following verses

(۱) سنريهم آياتنا في الآفاق وفي انفسهم حتى يتبين لهم انه الحق

(۲) الذي خلق سبع سماوات طباقاً ما ترى في خلق الرحمن من تفاوت فارجع البصر
هل ترى من فطور ثم ارجع البصر ينقلب اليك البصر خاسئاً وهو حسير -

(۳) وكأين من آية في السماوات والارض يمرون عليها وهم عنها معرضون -

(۴) ان السمع والبصر والفؤاد كل اولئك كان عنه مسئولا -

In these verses indebtedness of man to his Creator, perfection of creation and his accountability to the Lord have been highlighted It is, however, unfortunate that man, despite all such heavenly blessings, was ungrateful to his Lord [7] The third *Tarwīhah* defines the nature of associations (al-Jins, or temperamental affinity of good and bad characters with each other) A blind person, for example, feels comfortable only with a blind friend Evil goes with evil and virtue with virtue [8] Philosophy of renunciation and escapism has been rejected by al-Bīrūnī in the fourth *Tarwīhah*, for man is a social being and he can't live without a society, without a leader and without a political life God had created minerals like gold and silver to facilitate man's needs of social and political life [9] The tendency of accumulation and hoarding of wealth by the few has been condemned in the fifth *Tarwīhah* Al-Bīrūnī emphatically criticises such evil persons who deprive others from the use of gold and silver, which were not to be eaten by man but to be used for the welfare of man and of State In this respect metals were regarded as total good Man's ethics took a turn to selfishness which spoiled his virtues and manliness The hoarders and accumulators of gold, silver, metals and stones are condemned by al-Bīrūnī and have

been warned of severe punishments in the light of the following verse because they violate the divine ethics [10]

والذين يكنزون الذهب والفضة ولا ينفقونها فى سبيل الله فبشر هم بعذاب اليم

The main concepts of al-Bīrūnī's moral philosophy, are contained in his theories of *al-Murū'ah* (virtue) and *al-Futuwwah* (perfection), both being inter-related They are discussed in the sixth ***Tarwīḥah*** the former dealing with the ideal of manhood, valour, chivalry, generosity and sense of honour, while the latter treating the totality of noble character, chivalrous qualities of a man, his magnanimity, generosity and noble heartedness It was the designation of Islamic brotherhood of the Middle Ages and yet is used as names of several youth organisations in Arab countries *Al-Murū'ah* is a virtue centered on the individual, while *al-Futuwwah* is all embracing and beneficial to others Ḥātim of Tayī and Ka'b b Mama' al-Eyadī have been quoted by al-Bīrūnī as examples in this regard The Arab ideal oi generosity and hospitality is personified in Hātim, the source of many anecdotes The latter gave his life to save the life of his thirsty friend by his generosity An ideal and virtuous youth, according to al-Bīrūnī, is one who perceives the lawful and the forbidden (***halāl*** and ***harām***) as ordained by divine authority, and who is saturated with virtues like gentleness (*al-hilm*), amnesty (*al-'afw*), sedateness or grave manners (*al-rizāna*), toleration (*al-ihtimāl*) and modesty (*tawad'*) and who is devoted to the welfare of others An ideal youth is supposed to repel tyranny and protect truth and safeguard the rights of the neighbour, like Hātim, so well known for his magnanimity and noble heartedness (***karam*** and ***samaha***) Al-Bīrūnī quotes the following verses in support of his theory of *al-Futuwwah*

و ليس فتى الفتيان من راح و اغتدى   لشرب صبوح او لشرب غبوق

و لكن فتى ا لفتيان من راح و اغتدى   لضر عدو او لنفع صديق

> The ideal youth is not one who sets back and forth to drink radiant and bright morning and evening wine The ideal youth, on the contrary, is one who goes back and forth for the suppression of the enemy or evil and for the welfare of the friend (truth)

At the same time 'Alī b al-Jaham's verse is quoted in support of the theory of *al-Murū'ah* (personal virtue)

ولا عار ان زالت عن الحر نعمة   ولكن عاراً ان يزول التجمل

> There is no shame if an ideal free man or knight loses his prosperity and happiness but the real disgrace is if he loses courtesy, generosity and etiquette

Al-Bīrūnī is fully mindful to caution his ideal youth not to spoil his virtues by speaking of obligation and quotes the holy verse ولا تبطلوا صدقاتكم بالمن for

In this case not only virtues are lost but they are rejected by God Here again one can see how al-Bīrūnī's ethics is inseparable from his religious beliefs If Aristotle's young man ruled by uncontrolled impulses was not ready for the study of ethics, Bīrūnī's young man, devoid of *al-Murū'ah'* and of *al-Futuwwah,* was not mature enough for the study of ethics Al-Bīrūnī's moral philosophy is diametrically opposed to the utilitarian ethics [11] The sign of an intelligent man as described by al-Bīrūnī, in the seventh *Tarwīhah* lies in his perception of the blessings of Lord and not in getting involved in worldly luxuries and pleasures The intelligent man is always grateful to his Lord It is only an unintelligent person who is always lost in worldly pleasures with utter disregard to ethics Precious stones were in fact created for the use of the grateful and virtuous people and not for the wicked and avaricious, always running back and forth for false self-praise and worldly prestige and power

(يخرج منهما اللولؤ و المرجان فبای الاء ربكما تكذبان)

The eighth *Tarwīhah* deals with the variation of human nature, so avaricious for precious things The philosophy of love, which blinds a man has also been discussed here It has been concluded that excessive physical and worldly pleasures lead to exhaustion and thus negative virtues [12] The concept of *al-Murū'ah* has been further elaborated in the ninth *Tarwīhah* Desire for self-praise according to al-Bīrūnī is negation of virtues The philosophy of cleanliness has also been attributed to the concept of *al-Murū'ah* Personal cleanliness according to al-Bīrūnī, means cleanliness of heart and of intention and he says that

ومدار المروة على الطهارة و النظافة فان الدن اذ مل مل القلب

The second caliph once defined *al-Murū'ah* as cleanliness of clothes (انها النظافة في الثياب) The Qur'ānic injunction "Clean your clothes" (و ثيابك فطهر) has been interpreted by the exegetist as cleanliness of the heart and intentions Al-Bīrūnī supports this interpretation [14] The tenth *Tarwīḥah* further enumerates the virtues of a perfect man as being large-hearted to cover the weakness of others and help the needy Religion itself teaches justice and equality Al-Bīrūnī, emphatically asserts that it is not precious stones which decorate man's character, it is mainly qualities which adorn his conduct and it is a clean heart which pleases Lord The cleanliness of body and dress, as in the case of pilgrims, is metaphorical implying cleanliness of soul as well as of the body

ان من اظهر الا دلة على كمال المروة تكميل النظافة

Thus the perfection of cleanliness is analogous to the perfection of *al-Murū'ah* The noted emphasis of al-Bīrūnī on the cleanliness of soul and heart is a clear evidence that they are the main fountains of virtues, all good leading to happiness and to all good deeds like justice and other moral excellences, unattainable

by abstract reflections on empirical ethics Soul has been the centre of attention in all religious ethics although neglected in rational ethics, where logical dialectics serve as the basis of analysis of human nature, his concept of good and bad etc

The religious ethics of al-Bīrūnī is boldly projected in the eleventh *Tarwīhah* when he asserts that pleasure of God ought to be the objective of all human ethics, for it governs human conduct in terms of a choice of alternatives between good and bad, vice and virtue He condemns those who fear kings, who destroy human virtues for self-projection and self-glorification and negate the concept of *al-Murū'ah* The king would not hesitate in letting loose his tyranny in order to save his throne Thus a king cannot be a model of virtues Here we can see a revolutionary al-Bīrūnī, rising against the king, prone to destroy the concept of *al-Murū'ah* and of *al-Futuwwah*[16] The same idea is developed in the twelfth *Tarwīḥah* where al-Bīrūnī presents his theory of a welfare-state The wealth and treasures of kings according to al-Bīrūnī's moral philosophy were to be used for the welfare of the state and of its people and not for self-concerned individuals Virtue of wealth lies in being spent for the people[17] Dealing with the utility of wealth, al-Bīrūnī discribes in the thirteenth *Tarwīhah* how the rich and the poor used to save their wealth beneath the surface of the earth and how they were lost without being utilised either by the inheritors of the wealth or by the people of the state Thus the utility of wealth comes to zero This selfish conduct again negates the philosophy of *Futuwwah*[18] The fourteenth *Tarwīhah* deals with the problems of moveable wealth Kings would carry their wealth from place to place either for their own use or for the benefits of the public but as the problem of transport of gold and silver got difficult, they used to carry precious stones instead, in order to avoid the risk of theft or loss of gold or of silver Here al Bīrūnī philosophises his ethics in a most sophisticated manner He implies that it is quality rather than quantity that matters in ethics Virtues however small count much A man who piles a heap of sins in his life and lacks one single virtue is most unfortunate It is enough for a man to have few virtues to his credit for they were like precious stones After death, virtuous deeds, although few in number, can be a source of salvation[19] In the last *Tarwīhah* al-Bīrūnī again generalises his moral philosophy that the use of gold and silver utensils were forbidden for the simple reason that they were available only to few individuals, the kings or the rich, and not to the public and masses Thus a king's love for gold and precious stones, so transitory and unreal in nature, was hazardous and against the principles of *al-Futuwwah* Virtue alone is real It does possess infinity and eternity It is the misfortune of man who does not perceive this Truth Only few were endowed with divine wisdom to perceive truth[20] Here the ethical system of al-Bīrūnī in his *Kitāb al-Jamāhir* comes to a conclusion This preface, (before his first article on the precious stones), reveals al-Bīrūnī's religious mind whose ethical reflections governed his basic treatment of gold, silver and precious stones Finally he points out his primary sources and his indebtedness to his Lord who had enabled him to write a book on such an important subject[21]

Al-Bīrūnī and the Rationale Main Ethical Trends in the West—A Comparison

Whether al-Bīrūnī applied empirical methods to his analysis of ethics in *Kitāb al-Jamāhir* or not and whether he treated reason as the ultimate authority in religion and whether he was influenced in his treatment of ethics by Greek rationalism and naturalism, and if so in what ways, and whether he treated human nature as geometrical problem like Spinoza or whether he emphasised intrinsic value of the individual like Kant or whether he reduced ethics to calculus like Bentham or propagated a utilitarian ethics like J S Mill or criticised Bentham's hedonism like Bradley, are queries of most interesting nature

Being extremely precise, one can say that al-Bīrūnī in his *Kitāb al-Jamāhir* seems to be a true believer in revelations, the only source of human knowledge in regard to ethics and moral philosophy and the only basis of all human happiness Moral good and excellence lie in mainly virtues as defined in *al-Murū'ah* and *al-Futuwwah* Man must be grateful to his Lord, must obey His commandments, this being the only condition of human happiness Moral virtues must be all embracing and not individualised and selfish in nature Man should serve others and should emancipate himself from the love of gold and silver, so transitory and short lived in nature They were created by the Lord for the welfare of the state and its people and not for the specific use of glorification of the kings and the rich, who were prone to hoard them and to deprive others from their use Al-Bīrūnī during the whole course of his statements uses neither Greek rationalism nor any geometry or calculus On the contrary he quotes frequently like a devoted believer in revelation, verses from the revealed book, the Holy Qur'ān, as we have seen in preceding discussion The western ethical philosophy is confronted with two opposing schools One believing in empiricism and the other in revelation, rejecting the empirical and scientific verification in ethics for it was a normative discipline whose problem of "what ought to be" is insoluble by the factual or scientific methods Intuition of eternal moral laws or in other words revelation of a higher or supernatural world, beyond the jurisdiction of scientific method of inquiry, is the starting point of this school Being ethical absolutist in nature, the school maintains that if "good" virtues and human happiness were regarded as relative to human needs, ambitions and desires, then the concept of all moral claims and obligations were meaningless Al-Bīrūnī belongs to this very school and he opposes treatment of ethical valuation as hypotheses that arise out of cultural conflicts and have to be tested experimentally by their instrumental value in resolving such conflicts in our human relations He maintains that political, legal, educational and other social problems cannot be isolated from ethics If Plato and Aristotle teach that a good man is one who lives in accordance with the rational laws of the stable society, al-Bīrūnī teaches to live in accordance with divine decrees If Marx preaches to live in accordance with the economic interests of his class and if Nietzsche's (as iconoclast) ethics transcends all kinds of good and evil by breaking

with philistine notions and the slave morality of Christianity and preaches an ideal society of emancipated supermen, declares that God is dead and man is to take over, al-Bīrūnī's ethics teach to surrender before God and follow divinely guided ethics, a real source of all "goods" — happiness, justice and equality

Al-Bīrūnī in his *Kitāb al-Jamāhir* is free from rational dialectics of Socrates and of Plato who discuss on the intellectual levels "why is justice better than injustice" Happiness and well being, according to Aristotle are supreme to all human activities and good is equal to happiness But he concludes that there is little agreement about what constitutes happiness (see ten chapters of Nicomachean Ethics for Aristotle's moral and intellectual analysis) Al-Bīrūnī has solved this crisis by preaching happiness, achieved merely through obeying revelations Al-Bīrūnī is opposed to pleasure in abstract sense He is opposed to all those who want to accumulate wealth, power, social fame and public prestige in addition to sensuous excitements (food, drink and sex) in order to suppress the State and its people He is opposed to pervasive happiness He, like Plato and Aristotle, does not establish an absolute cause of all goodness, and has no empirical approach to ethics In Aristotle's eyes the good man is one whose activity and ethics is guided by reason while al-Bīrūnī is not in favour of the use of scientific reasoning in ethics like those of naturalists or mathematicians or pure theoreticians who seek to demonstrate their conclusions with logical certainty Al-Bīrūnī cannot agree with Aristotle and Dewey who regarded good as relative to man's interest Al-Bīrūnī does not subordinate ethics to human nature but subordinates human nature to religious ethical theory Spinoza treats human nature as he treats geometrical problems to prove scientific objectivity and rational method of proof into ethics and concludes that since emotions follow ordinary laws of nature which are always the same, human nature must be governed by some fixed laws He thinks that application of geometry to ethics may lead him to deduct fixed universal traits in all human beings The only salvation according to him lay in the use of reason But al-Bīrūnī preferred revelation to geometry

Immanuel Kant seems to be much closer to al-Bīrūnī than any other Western philosopher for the simple reason that he believed in the higher moral world not limited by space and time He attacked social utility and pleasures and inadequate ethical standards or guides to the individual sense of duty The "good" for Kant is absolutely independent of the empirical facts or laws He says that nothing in the laws of natural sciences tells us that we ought to treat human beings as moral ends in themselves Kant, however, thinks that goodwill is the sterling quality of all ethical characters, and good faith, the moral basis of legal contracts The greatest contribution of Kant's ethics is its emphasis on intrinsic values of individuals as ends in themselves Such discussions seen to be not relevant for al-Bīrūnī's ethics in his *Kitāb al-Jamāhir* Bentham's hedonistic ethics, being based on a calculus of pleasure and pains, teaches what to seek and what to avoid in our private and public life He says that good is whatever promotes the happiness Thus he reduces ethics to calculus J S Mill, like Bentham, is a utilitarian The utilitarians reject the two worlds of Kant, the physical

and the spiritual, the temporal and eternal to which body and soul belonged separately The utilitarians wanted to bring ethics closer to natural and social sciences Their basic belief is that moral conceptions and standards must be continually subject to revision Consequently, they reject the aristocratic ethics of Plato and Aristotle The *a priori* ethics of Spinoza, the supernatual revelations of medieval moralists, the intuition of Protestant ethics, the two worldly systems of Kant according to them belonged to the past, and to the passing culture and needed revision in the scientific and technological era The basic belief of utilitarians is that good is not absolute, self-sufficient and final terminal of moral action It depends always on psychological, social and historical circumstances, in which reflections over what is desirable, play a decisive role, namely an individual citizen could accept bribe and both Mills and Dewey would allow him to do so, for the utilitarian formula of the "greatest good for the greatest number" will not object to it But al-Bīrūnī's ethics will not permit any one to accept bribe no matter what the circumstances are or were, for his ethics was not relative to human interest but to divine injunctions F B Bradley's arguments, although dialectical, expose formal contradictions and incomplete character of empiricism in ethics He criticises Bentham's hedonism and Mill's utilitarianism and defends self-realisation as more concrete goal of a moral activity than evanescent pleasures or happiness in the abstract Mill is censured for his vague and unattainable ideal in his principle of the greatest happiness for the greatest number Yet Bradley has no kinship with al-Bīrūnī

While comparing al-Bīrūnī's ethics with dialectical rationalism, we have to conclude that al-Bīrūnī depends more on revelation rather than on rationalism or empiricism and in his *Kitāb al-Jamāhir*, his main sources of inspiration are the Holy Book, the traditions of the Prophet and acts of those around the Prophet

Al-Bīrūnī and Professor Eduard Sachau

In the light of the foregoing discussions one can easily decide whether al-Bīrūnī was a good Muslim, a true and devoted believer or a bad Muslim as Professor Sachau maintained In the preface (English edition) of ***Kitāb al-Āthār al-Bāqiyah an al-Qurūn al-Khāliyah*** (by al-Bīrūnī) edited by Professor Sachau, the editor has claimed that al-Bīrūnī was (1) a bad Muslim (2) a despiser of the Arabs and of Arabic sciences and finally (3) he was not a Sunnī-Muslim How can al-Bīrūnī be a bad Muslim when he follows the Qur'ān and Sunnah in a devoted fashion His whole writing in ***Kitāb al-Jawāhir*** contradicts and rejects this theory of Sachau No statement on ethics are made without having been supported from the Qur'ān The greatest good on earth was devotion to and service of human beings as explained in ***al-Futuwwah*** (the perfection) Al-Bīrūnī preaches gentility, amnesty, sedateness, toleration, modesty, magnanimity and large heartedness as prescribed and defined by the Qur'ān and the Sunnah and not as dictated by human rationale often motivated by individual selfish interests and desires His writings in ***Tarwīḥahs*** prove that he was an orthodox and God-fearing Muslim Sachau's

views have been refuted by another German scholar Professor Krenkow, who worked all his life on al-Bīrūnī, and edited his *Kitāb al-Jamāhir* and supported Taqī al-Dīn al-Hilālī on this issue[22] Al-Bīrūnī was a devoted Sunni-Muslim for in the eleventh *Tarwīhah* he reveals that in 'Alī he saw the fourth caliph, which shows that he did not believe in the theory of divine determination of 'Alī Moreover al-Bīrūnī praises the well-guided four caliphs and praises 'Umar b 'Abd al-'Azīz as well as the caliphs of the Marwanids He praises only few of the Abbasid caliphs These beliefs clearly represent well known Sunnī school of thought[23] Al-Bīrūnī was neither an enemy of the Arabs nor despiser of Arabic sciences as Professor Sachau has held On the contrary, he was a friend of Arabs and preferred them to others for they had *al-Murū'ah* and some of them even sacrificed their belongings and their lives for the service of others In the ninth *Tarwīhah* he speaks highly of Arabian folk and refers to them as an ideal The eleventh *Tarwīhah* and fourteenth *Tarwīhah* reveal how he admired the Arabs and[24] how high in esteem was Arabic science in his eyes He regarded al-Kindī as the greatest philosopher of the Arabs[25]

From these documentary evidences, it is quite manifest that Professor Sachau lost objectivity in his evaluation of al-Bīrūnī

Al-Bīrūnī and the Department of Sindology

There is a great deal of controversy as discussed in this Congress on the question of the birth place of al-Bīrūnī Some of the early Arabic writers claim that al-Bīrūnī hailed from Sind (now a province of Pakistan), and Bīrūn was a town in Sind The two primary Arab sources among others to be cited are Ibn Abī Uṣaybo'ah and Shahrazūrī They, in their books *Ṭabqāt al-Aṭibbā* (vol 2) and *Akhbār al-Ḥukamā'* respectively claim that al-Bīrūnī's origin goes to Sind The latter also describes the fauna and flora of the city and its splendid views and says that there is no wonder that such a genius as al-Bīrūnī hailed from such a beautiful city namely *Bīrūn* in Sind[26]

The theory of al-Bīrūnī's origin has, however, been questioned by other scholars who maintain that al-Bīrūnī belonged to Khwārizm Some of them quote *Kitāb al-Masālik* by Ibn-Ḥauqal, an atlas, which shows a city *Nīrūn* in Sind and not Bīrūn They maintain that Nīrūn was mistaken as *Bīrūn* by sheer misunderstanding They also quote Sam'ānī's *Kitāb al-Anṣāb* and Yāqūt's *Mu'jam al-Udabā*, in support of their statements[27]

The difference of opinion on *Bīrūn* and *Nīrūn* is not the subject of our present discussion The main point revolves round a question "what further advancements were made in this field of research by the Department of Sindology devoted to discover every intellectual avenue related to the province of Sind?" If no research is conducted in this regard it is amazing Everyone would agree with this proposition that no matter whether al-Bīrūnī belonged to Sind or to Khwārizm, a research ought to have been advanced on this issue by the Institute of Sindology Is it not amazing that *Kitāb al-Jamāhir* is translated in Russia[28]

but not in Pakistan where the Department of Mineralogy needed its help more than that of Russia It should have been translated by experts in any language of Pakistan, either in Sindhi, Panjabi or in Urdu, the national language It might have introduced us to the precious stones and its history as al-Bīrūnī had described in his first article about *Jawāhir* where he discussed the form, circumstances, history and goodness of the precious stones like

العرجان - اللولوه - السبادج - الالماس - البجادى - اللعل البدخشى - الياقوت

And their names as known to linguists and jewellers along with their prices and we might have been benefited by the oceanographic knowledge of al-Bīrūnī and the art of diving etc and by the valuable information about الزمرد and its forms الفيروزج and other relevant information about it

اللازورد - الجمست - البسد - البلور - الجزع - العقيق - السبج - اليشم

and by the scientific and chemical information about

الكهرباء - الموميائ - الخماهن - المقناطيس

etc etc[30] Moreover, we might have been able to understand the contemporary prices of precious stones and the relationship between coins and precious stones We might have known more about

النحاس - الفضة - الترى - الا يعفدوى - الخاصيى - اسرب - الحديد

etc along with the mineralogical knowledge of al-Yama[31]

If more discoveries were made in regard to al-Bīrūnī's birthplace and some more light was shed on the dark film, it might have widened the intellectual avenues of research It does not mean that a forced judgement to prove that al-Bīrūnī belonged to Sind is made On the contrary, it simply means a sincere and honest attempt on the part of scholars to push the territory of this research further ahead

Knowledge and civilisations have neither frontiers nor boundaries nor nationalities nor have they directions of east or of west, of south or of north Dr Nitobe once remarked so truly that "the East is in the West and the West is the East—there are no points in the compass of the soul"[32] Whether al-Bīrūnī belonged to Sind or to Khwārizm, his knowledge is and shall ever remain the common heritage of humanity, either in the East or in the West

Conclusion

It can safely be concluded that the main sources of al-Bīrūnī's ethics were revelational without being influenced by rationalism or naturalism and he was a true devout Muslim and not a bad Muslim as Professor Sachau had thought

Al-Bīrūnī's refusal to apply empiricism to ethics and moral philosophy does not minimise his position as a great scientist and empiricist in other fields of science Human history is indebted to him for his contribution to mathematics, astronomy, geology, pharmacology, history, geography, linguistics, religion, ethics and philosophy

REFERENCES AND NOTES

1. This date given by Şachau in the preamble of his Chronology of Ancient Nations has been questioned by Taqī ud-Dīn al-Hilālī in his Die Eileitung Zu al-Bīrūnī Steinbuch, Leipzig 1941, p VII He, on the authority of Professor Krenkow says that Sachau's date is not in agreement with al-Bīrūnī's statement who says himself in the introduction to *Kitāb al-Şaydanah*, that he was already eighty years at that time, which contradicts Sachau's dating See pp VIII and IX

2 The book is divided into three parts (1) The Preface (Hyderabad ed) pp 1-32, (2) First article dealing with precious stones, pp 32-228 also pp 1-11 appended at the end of the book (3) Article dealing with coins and precious stones and their interrelationship, pp 228-271

3 Abstract ethical principles cannot however, make a "good person", for ethics are discussed here merely as verbal and intellectual exercise Professional codes of ethics, and other practical precepts of conduct belong to the study of applied ethics and homiletics Socrates promoted ethics as rational discipline when he requested people to define justice, courage, friendship and clarify their ideas For detailed abstract discussions, Plato's *Republic*, Aristotle's The *Nicomachean Ethics* Benedict de Şpinoza's *On the Improvement of the Understanding and Of Human Bondage, or the Strength of the Emotions* - Immanuel Kant's *The Metaphysics of Morals*, or Jeremy Bentham's *An Introduction to the Principles of Morals, and Legislation*, John Stuart Mill's *Utilitarianism*, F H Bradley's *Pleasure for Pleasure's Sake* - John Dewey's *Does Human Nature Change*

4 Al-Bīrūnī, *Kitāb al-Jamāhir fī-Ma'rifah al-Jawāhir*, edited by Professor Krenkow (Hyderabad, 1355 A H), pp 3-32

5 *Ibid*, p

6 *Ibid*, p 4

7 *Ibid*, pp 4-6

8 *Ibid*, p 6

9 *Ibid*, pp 6-8

10 *Ibid*, pp 8-10

11 *Ibid*, pp 10-12

12 *Ibid*, pp 12-14

13 *Ibid*, pp 14-17

14 *Ibid*, pp 17-22

15 *Ibid*, pp 22-24

16 *Ibid*, pp 24-26

17 *Ibid*, pp 26-27

18 *Ibid*, pp 27-28

19 *Ibid*, pp 28-30

20 *Ibid*, pp 30-31

21 *Ibid*, pp 31-32

22 Taqī al-Dīn al-Hilālī, Die Einleitung zu al-Bīrūnīs Steinbuch mit Erläuterungen übersetzt (Samml Orientalistische Arbeiten, 7, 24 cm, Leipzig 1941 (pp V-XXI), see pp VII-XII

23 *Ibid*, pp XII-VIX See the original text as follows

"Die zweite Frage ist, ob al-Bīrūnī Schiite oder Sunnite war? Ich habe schon daraufhingewiesen, dass Brockelmann sagt, dass al-Bīrūnī in seiner Jugend Schiite, wie alle seine Landsleute war, und dass er nicht ernstlich an religiosen Fragen interessiert war und sich später der sunnitischen Orthodoxie angeschlossen hat Ich habe Zweifel, ob das Volk dem al-Bīrūnī angehörte, schiitisch war Ferner habe ich bis jetzt keinen Hinweis darauf gefunden, dass al-Bīrūnī in seiner Jugend Schiite war Ich habe schon ausfuhrlich daraufhingewiesen, dass die Annahme, dass unser Verfasser an religiosen Fragen nicht ernstlich interessiert war, nicht zu Recht besteht, im Gegenteil, ein Mann, der so wie al-Bīrūnī sein ganzes Werk auf die religiosen Gesetze des Islam aufgebaut hat und tief in die Lehren desselben eingedrungen ist, von dem kann man nicht annehmen, dass er ohne Skrupel seine religiose Richtung ändern konnte Wenn ein solch grosser Gelehrter einen derartigen Schritt getan hätte, hätte sicher Yakut dies vermerkt Wir finden jedoch keine Angabe bei ihm Im Folgenden nun fuhre ich die Stellen aus seinem Vorwort an, aus denen wir klar ersehen, dass al-Bīrūnī Sunnite war Wenn al-Bīrūnī die Definition der Muruwwa auf Grund verschiedener Quellen anfuhrt, gibt er die folgende Geschichte als Beispiel der vollkommenen Muruwwa (5 39) Mu'izz al-Dawla, ein äusserst strenger Schiite, wollte das sunnitisch abbasidische Kalifat abschaffen Er liess deshalb einen vornehmen und bekannten Aliden aus Persien kommen, bot ihm das Kalifat an und versprach, ihn mit all seiner Machtzu schützen Dieser ging jedoch auf seinen Vorschlag nicht ein Nachdem er dem Herrscher zunächst gedankt hatte fur seine Liebe und Treue zu den Aliden, sagte er ihm, dass dies nur die Ursache vieler Kriege und Unruhen sein wurde und man nicht wisse, ob dieses Gewinn sei oder nicht Alle Gläubigen vertrauen den Abbasiden und misstrauen den Aliden Das Beste werde sein, die Lage nicht zu

verändern. Da weinte Mu'izz ad-Dawla vor ihm und dankte ihm für seine Leitung, dass er ihn aus diesem Irrtum herausgeführt habe. Diese treffende Geschichte, die al-Bīrūnī für seine Einleitung ausgewählt hat, zeigt uns, dass dieser Alide in seiner Weigerung, das Kalifat anzunehmen, die höchste Stufe der Muruwwa erlangte, und dass al-Bīrūnī ein überzeugter Sunnite war, denn sonst hätte er sicherlich nicht diese Erzählung angeführt

In der 11 Tarwiha spricht er darüber, dass den Menschen immer ein Herrscher oder Kalife nötig sei, da die Menschen auf Erden ohne rechte Leitung und Führung zugrunde gehen Wenn jedoch der Herrscher nicht stark und mächtig genug sei, sein Drohen und Versprechen auszuführen, dann könne er nicht regieren, denn jeder glaube dann herrschen zu können Das Herrscheramt sei, damit kein Streit unter den Stämmen sei, auf einen Stamm beschränkt, und zwar auf den besten Mann dieses Stammes und seine Söhne Dies genüge jedoch nicht, wenn nicht der göttliche Beistand und die Bestimmung Gottes auf eine Familie hinzutrete So sei es in Persien zur Zeit der Chosroen gewesen, und im Islam beschränke sich das Kalifat auf die Quraisch Dies zeigt deutlich, dass al-Bīrūnī Sunnite sein musste, ein Schiit konnte unmöglich eine solche Ansicht vertreten, denn sie glauben an die göttliche Bestimmung Alis Die Sunniten erkennen Ali als den vierten Kalifen an, während die Schiiten sagen, dass Ali unmittelbar auf Muhammad folgen musste Eine Ausnahme bilden nur die Zaiditen

In der 14 Tarwiha spricht al-Bīrūnī über die Verfügung und Verwendung der Güter durch den Herrscher Er lobt in dieser Hinsicht die vier rechtgeleiteten Kalifen und 'Umar b 'Abd al-'Aziz und die meisten Kalifen von den Marwaniden, und nur einige von den Abbasiden Kein Schiite konnte so sprechen, denn die Marwaniden sind nach dem Glauben der Schi'a die Feinde der al-Bait, das heisst der Familie des Ali

24 pp XIV - XV

25 pp XV

26 Al-Bīrūnī الاثار الباقيه عن القرون الخاليه edited by Dr C Eduard Sachau, Professor of Oriental Studies, University of Berlin, Maktabah al-Muthannā, Baghdad 1923 (date on the preface of the first edition is July 20, 1878, Berlin), p LIII Sachau quotes al-Shahrazūrī from manuscript (Ms Or Octav 217 Bl 170 a) the content is given as below·

ابو ريحان محمد بن احمد البيرونى و بيرون مدينة بالسند و كان من اجلاء المهندسين
وقد سافر فى طلب العلم فى بلاد الهند اربعين سنة و صنف كتباً كثيرة وله مناظرات مع

ابى على ولم يكن الخوض فى بحارالمعقولات من شانه (١٤٠٦) " وكل ميسر لما خلق له ورادت تصانيفه على حمل بعير وكان موفقا فى هذا السعى المشكور و بيرون هى التى منشاء و مولده بلده طيبة فيها غرائب و عجائب ولا غرواان الدر ساكن الصدف ومن كلامه سهولة الشئ و صعوبته قلما تطاق و انما تصاناان اليه بحسب اختلاف الا حوال ليسهل لهامن جهة و يتعذر من اخرى و قال دراسة اخلاق الحكماء و العلماء تحيى السنة و تميت البدعة و السنن الصالحة علامات الخير و الحق لكل يوم امر حاضر و لكل غد ما فيه يحدث و بلغنى انه لما صنف القانون المسعودى اجازه السلطان الشهيد حمل الفقرة فرده الى الخزانة فقد اباى الاستغناء عنه و رفض العادة فى الاستمناء و كان مع الفسحة فى التعبير و حلا بالحال فى عامة الامور مكبا على تحصيل العلوم و تصنيف الكتب يفتح ابوابها و يحيط مشوا كلها و اقرابها ولا يكاد يفارق يده القلم و عينه النظر و قلبه الفكر الا فى يومى النيروز و المهرجان لا عداد ما يمس الحاجة اليه فى المعاش من بلغة الطعام و علقه الرياش ـ

27 Al-Bīrūnī commemoration volume A H 362, A H 1362, Calcutta, 1951 See the article on al-Bīrūnī by Maulana 'Abd al-Salām Nadvi, p 255

28 The writer of these lines during his recent visit to England and France (July - September, 1973) came across the Russian translation of *Kitāb al-Jamāhir* at the Cambridge University, whose details are given as below

"Collection of Information for the Identification of Precious Stones" (Mineralogy)

Translated by A M Belenitsky, Edited by Professor G G Lemm Lein Professor Kh K Baranev and A A Dolima with articles and remarks by A A Belenitsky and G G Lemm Lein

Published by Academy of Sciences (Moscow) 1963

It has a supplementary passage from the book al-Hazini '*Versy Mudresti*" (Scale of Intellect) containing abstracts of the treatise of al-Bīrūnī on the relationship between metals and precious stones (In Russian text the writer has been helped by Dr M Azīmullah)

29 Al-Bīrūnī, *Kitāb al-Jamāhir, ed Krenkow,* Op cit See المقالة الاولى فى الجواهر pp 32-138 *al-Maqālah al ūlā fī al-Jawāhir*

30 *Ibid*, المقالة الثانية فى الفلزا pp 138 - 228 *al-Maqālah al Thāniah fī al-Falrā*

31 *Ibid*, pp 228-221

32 Soichi Saito, *In East and West, Conflict or Co-operation?* (Student Christian Movement Press, London 1936) p 112

AL-BĪRŪNĪ THE GREATEST ASTROLOGER OF THE TIMES

DR M. S. NAMUS

WITHOUT doubt al-Bīrūnī is the greatest astrologer of his times He is a practical practising astrologer, as well as one of the greatest and original authors of the world on the art of astrology He combines in his genius a thorough knowledge of astronomy, geometry, arithmetic surveying, geography, and astrology These are the basic branches of knowledge on which the art of ASTROLOGY is founded In fact he has produced works on all the branches of human knowledge which existed in those days And he discusses all the subjects in a masterly manner This statement sounds like a sorcerer's bluff But I am giving you actual facts All this store of knowledge is correlated by al-Bīrūnī, and is judicially used by him, in his intellectual productions

During his lifetime al-Bīrūnī compiled about 150 large or small works on various subjects The range of science subjects covered by this genius is astonishing astronomy, mathematics, chronology, mathematical geography, physics, chemistry, mineralogy, precious stones Along with these he composed about 20 books on India both translations and original From the ancient lore of Iran, he composed a number of tales and legends He wrote the history of his native land Khwārizm, and a history of the sect of Qarmatians (*Kashf al-Zanūn of Hājī Khalīfah*)

Besides these there are other books written by al-Bīrūnī on other subjects poetry, pharmacy, history, geology, botany, philosophy, etc, etc Astronomy and astrology are his major subjects In fact the field of literary activity of al-Bīrūnī is so wide that it covers all the knowledge which was known to the civilised world of those days He wrote in Arabic the learned language of the glorious period of Islam He wrote some of his works in Persian His major work in Persian is on astrology, although there is another book on astrology of exactly the same title *Tafhīm al-Najūm* by al-Bīrūnī which is in Arabic

Al-Bīrūnī is a master of many languages His talent in Arabic and Persian is confirmed by his works For writing his book on chronology of ancient nations and to learn astronomy and astrology of the ancients, he studied Aramaic and Syriac He quotes passages from books of these two languages

in his works In India he studied Sanskrit, and became such a great master that the Pandits of India gave the title of 'Vidya Sagar' Ocean of Learning, to him

We are at present concerned with his knowledge of astrology. Al-Bīrūnī is the author of a number of books on astrology The two major works on astrology have got the same title كتاب التفهيم لأوائل صناعة التنجيم *Kitāb al-Tafhīm li awāil Ṣanā'ah al Tanjīm* One is in Arabic and the other in Persian The two run so close to one another in the matter of their body, that one seems to be the translation of the other Nobody has been able to decide positively, which of these two versions, has served as basis for writing the other

We will take up the Arabic book on astrology first Full title of the book is

كتاب التفهيم لأوائل صناعة التنجيم

Kitāb al-Tafhīm li awā'il Ṣanā'ah al-Tanjīm

(The book of Instruction in the Elements of the Art of Astrology) Written in Ghaznah, 1029 A D

Reproduced from the British Museum Manuscript No Or 8349

The translation facing the text by R Ramsay Wright, M A Edin, LLD Tor and Edin Emeritus Professor of Biolcgy, University of Toronto, 1934, London, Luzac & Co 46, Great Russell Street

(Punjab University Library Lahore, No Ar h/III 194)

NOTE The edition is limited to one hundred copies of which this is No 77)

The Arabic in this book is a photographic copy of the text given in British Museum Manuscript No Or 8349, written in 1029 This is on the left hand page The total number of folios in the book is 333 (very thick paper)

The total number of Bābs (باب) singular, (ابواب) plural) Sections in the original Arabic text, is 530 The translator R Ramsay Wright has divided these 530 paragraphs according to modern methods into 13 chapters The related paragraphs have been placed under one chapter

The book has been divided into two major parts

(a) Astronomy Paras 1-346 in Arabic original

(b) Astrology Paras 347-530 in Arabic original

Part I of the Book

Chapter 1 (Para 1-71 of original Arabic) ***ASTRONOMY*** (a) ***Geometry***

It deals with geometrical definitions and propositions from Euclid

Chapter 2. (Paras 72-119 original): (b) *Arithmetic*.
Arithmetical operations, Decimal notation, Algebraic representation of numbers by letters

Chapter 3 (Paras 120-235) *PURE ASTRONOMY*
Spheres, Stars, Planets, Ecliptic, the Signs, the Planets, Combustion and Conjunction with the Sun, Moon, Fixed Star, Mansions of the Moon, The Galaxy, Parocliptic, Apogee of the Sun. The amount of movement of the Sun in the Ecliptic, Orbits of Planets and Moon, Daily Rate of Movement of the Planets, World Days, World Years, Size of Planets, Earth, Altitude, Zenith, Gnomon and Shadow, Azimuth of Qiblah, Time of Prayers, Direction of Mecca, and other matters

Chapter 4 (Paras 236-241) *GEOGRAPHY*
Earth, Seven Climates, Cities in seven climates

Chapter 5 (Paras 242-267) *ASTROLOGICAL ASTRONOMY*
Co-ascensions of Equinoctial and Ecliptic, ascendent Houses, their angles, Anniversary, Conjunctions of Saturn and Jupiter, Conjunction and Opposition of Moon, Phases at which forecasts are made, Eclipses of Moon, Sun, Parallaxis

Chapter 6 (Paras 268-323) *CHRONOLOGY*
Solar and Lunar years, Hindu names for Days of the Week, Various Nations, their Dates, Cycles, Eras (Jewish, Christian, Muslim, Persian), Days in Greek, Persian Calendars

Chapter 7 (Paras 324-346) *ASTROLABE*
Parts, kinds, uses

Chapter 8 (Paras 347-380) *THE SIGNS OF ASTROLOGY*
Their nature and characteristics, influence on character, figure, face, profession, diseases, crops, animals, Years of the Signs, Signs and Planets in Aspect and Conjunction, relations other than aspect, Ascending and Descending halfs of the Zodiac, Triplicities and Quadrants of the Zodiac, etc

Chapter 9 (Paras 381-447) *THE PLANETS*
Their nature and characteristics, their years, indications of soils, buildings, countries, jewels, foods, drugs, animals, crops, parts of the body, Disposition, Numbers, Diseases, Professions, etc , Domiciles, Determinants, Lord; Planets in Aspect, friendship and enmity of Planets

Chapter 10 (Paras 448-460) *DIVISION OF SIGNS*
Faces, Decenates, Ptolemy's Thirds, Terms and their Lords, Characteristics of Degrees of Signs

Chapter 11 (Paras 461-474) *THE HOUSES*

Tables of indications of Nativities, at Horary Questions. as to Organs, Powers, Strength of Planets in Joys, Sex Characteristics of Groups of Houses in Threes and Sixes

Chapter 12 (Paras 475-514) *THE PART OF FORTUNE*

Relative positions of Planets and Sun Orientality, influence changed under certain conditions, application and separation Dead Degrees, Dignities Favourable, Unfavourable situations of Planets in the Signs and Houses, Substitute for Conjunction and Aspect, Strength and Weakness of Planets, etc

Chapter 13 (Paras 515-530) *JUDICIAL ASTRONOMY*

The five divisions and their astrological principles, Lord of the year Salkhuda, conditions of Nativity, gifts of length of life, procedure at birth, Elections, selecting suitable time for action General questions, thought reading, danger of hasty conclusions

A person who is conversant with the art of astrology and astrological methods, will immediately conclude that only an author who is master of the subject can write such a book If you go through the original Arabic work of al-Bīrūnī, you will feel convinced that the author has a conviction about the facts of the subject, he is a thorough master of the field, the details are perfect, the diction is clear and forceful, and the treatment is so scientific In these pages you meet a great scholar, a great author, a great scientist and a great astrologer

Another book on astrology, was also written by al-Bīrūnī in Persian The title of this book is also the same as that of the Arabic book

كتاب التفهيم لاوائل صناعة التنجيم

It has been edited by Āqā'i Jalāl Humā'i and published by CHAPKHANA MAJLIS (Majlis Press) in the years 1316-1318 Solar Persian

Total pages Muqaddimah (Introduction) to قص (1 to 100 plus 90 190) Body of the Book, 677 pages

(Punjab Public Library, Lahore Persian Section, Call Number 523 Accession Number 1502)

It is a praiseworthy production in all respects editing, explanatory notes, depth of understanding of the subject, and printing

Abu Raiḥān Muḥammad bin Aḥmad al-Bīrūnī has written almost all his works in Arabic This book is in Persian, Āqā'i Jalāl Humā'i writes (page 26 Muqaddimah)

آثار ابو ریحان در زبان تازی فراوان است ۔ اما در فارسی یگانه اثری که از وی
باقی مانده ، همین کتاب است که به عقیده من اگر همه جهات را از قبیل اشتمال مواضیع
علمی و فوائد تاریخی و قدمت و صحت و اعتبار مطالب و اهمیت ادبی و امثال اینها
در نظر بگیریم ۔ بی شبهه بزرگترین و بهترین یادگارهای فارسی است و در سراسر آثار
فارسی بعد از اسلام هیچ نظیر و مانندی برای او نتوان یافت ۔

(Translation "There is a large number of compilations of Abū Raiḥān in the Arabic language But in Persian this is the only compilation from his pen, which survives According to my belief (says the editor of the Persian version) judging it from all the criterions inclusion of learned discussions, historical usefulness, antiquity and precision, and truthfulness of the subject matter, literary importance, and other qualities like this, without doubt this is the biggest and the best monument in Persian And after the rise of Islam, in the whole range of Persian works, nothing can be found which can be compared to it, or is like it")

Before we proceed further, it seems necessary to express the peculiarities of the Persian language of al-Bīrūnī The language used by al-Bīrūnī is the Old Persian which was current in the period when al-Bīrūnī was alive We may also keep in mind that al-Bīrūnī spent his life in Khwārizm, its surrounding area, Ghaznah which is in Afghanistan, and India In these areas Persian was not the first mother tongue, but was used as the second mother-tongue, and as literary and court language This is the Eastern or Turkistani branch of Persian which differs in its stock of words from the Western or Faris branch, current in Western Persia, where Persian is the first mother-tongue Eastern branch has got an admixture of Turkistani, Pashto and Indian words in its stock, though in a Persianised form Western branch has got a larger number of original Pahlawi and Dari words in it

In phonetic values of the phonemes of the two branches differ distinctly On hearing you immediately discern the difference The two speakers also feel a strangeness in the comparative values of the phonemes, as spoken by them, although they can fairly understand one another

The great scholar and diligent researcher, Aqā'ī Jalāl Humā'ī has explained the peculiar words in the narrative of al-Bīrūnī from page قکط 129 to page قف 180 of the Muqaddimah

Now we possess two works from the pen of al-Bīrūnī on astrology Both are named كتاب التفهيم التنجيم One is in Arabic and the other is in Persian We cannot judge whether the Arabic version was written first or the Persian version But it is clear that the second version, whichever it may be, was written by the great author, keeping the first version before him, right under his nose The two follow one another closely But both are so independent in

their diction that one does not seem to be a translation of the other A scholar who studies any one of these two versions, without comparing it with the other, concludes that it is an independent compilation

Al-Bīrūnī writes as an introduction in the beginning of the book (Page 2 of the body of the book)

بسم الله الرحمن الرحیم

کتاب التفهیم لاوائل صناعة التنجیم

عمله ابو الریحان محمد بن احمد البیرونی علی طریق المدخل

دانستن صورت عالم. و چگونگی نهاد آسمان و زمین و آنچه میان هر دو است
از روی شنیدن و بتقلید گرفتن همچون چیز های سخت سود مند است. اندر پیشه نجوم.
از براک گوش بنامها و لفظ ها که منجمان بکار دارند خو کند و صورت بستن معانی
آن آسان گردد. تاچون بعلت ها و حجت هائی آن بار آید و آنرا بحقیقت خواهد تا بداند.
از اندیشه و فکرت آسوده بود. و رنج آن هر دو سو براو گرد نیا دید.

و این یادگار همچنین کردم مو ریحانه بنت الحسین الخوارزمی راکه خواهنده او بود.
بر طریق پرسیدن و جواب دادن. بر روی که خوبتر بود و صورت بستن آن آسانتر.

و ابتدا کردم به هندسه. پس به شمار. پس به صورت عالم. پس به احکام نجوم
ازبراک مردم نام منجّمی را سزاوار شود تا این چهار علم را بتمامی نداند و ایزد
تعالی توفیق دهنده است. بر صواب گفتار و کردار بمنت خویش.

Translation In the name of Allah, the Compassionate, the Merciful This is the Book for understanding the elements of the Art of ASTROLOGY, which has been compiled by Abū al-Raiḥān Muḥammad bin-Aḥmad al-Bīrūnī, according to those methods by which a beginner should begin to learn the subject

By this subject we understand the nature of the universe, the causes and reasons of the nature of the sky and earth, and what is in between these two We do this by our observation and by following the conclusions of the great masters These things are very useful in the profession of ASTROLOGY

For this reason it is necessary for the learner to make his ear familiar with the names and words which the astrologers make use of, in practice As the mind of the learner comes back from the abstract discussions of reasons and causes of the fundamentals, it becomes easy for the student to give necessary shape to the meaning of the subject His doubts are cleared and his thinking faculty is ripened And the grief which he would encounter

by not following these lines of instructions, does not collect round him on all sides

According to the special request of Raiḥānah bint Ḥusayn al Khwārizmī, I have compiled this memorial present As she desired it, the book has been written in the form of questions and answers, which is a better way of explanation, and an easier form to put down on paper and to understand

I have started with Geometry Then I have given the methods of Calculation, then the Form of the Universe, then the Laws of Astrology I have done this with the purpose that no person is fit for being called a *Munajjim* (astrologer) unless he learns thoroughly these four branches of learning

* And God on High is the Benefactor, who through His divine grace bestows powers on any person to complete a task This is accomplished in words and deeds of the person

* * * * * *

In this monograph there is no space to discuss the principles on which astrology is based We have confined ourselves to one point of discussion only We wish to know the opinion of al-Bīrūnī himself regarding the validity of the findings and verdicts of astrology We will search out from the book تفهيم التنجيم (Arabic version) the words of al-Bīrūnī in this regard to arrive at a proper conclusion Al-Bīrūnī is a highly scientific and scrupulously clean writer He does not allow his personality or personal opinion to appear on paper

(P 317) Al-Bīrūnī discusses the divisions of judicial astronomy, and states that astrology has got four divisions like the four elements which make up the world

(1) Water, (2) Air, (3) Fire, (4) Earth After discussing the four divisions of astrology, al-Bīrūnī says

"All these are founded on beginnings or origins (*Mabādī*) (which are) possibly trivial" (P 319)

Al-Bīrūnī at the end of the book has himself tried to give a judgement on the validity of the verdicts of astrological calculations He has divided the astrological verdicts into 5 sections

(1) NATURAL PHENOMENON clouds, rain, snow, thunder, rainbows, meteors, atmospheric phenomenon, earthquakes, floods in rivers and tides in oceans Here the four elements express their vitality in a single form

(2) In the second section of astrology mixed elements exert their powers Plants, animals, are included in this section The effect may be on an individual or a group, failure of crops, epidemics There is another variety in this section battles, struggle for power, revolutions, new religions and sects, which affect groups of people

(3) The third section is concerned with the human individual his events of life, personal diseases, progeny

(4) The fourth section is concerned with human activities and occupations

What he means to impress is that the 4 sections of astrology given above have got some foundation to formulate cause and effect, i e , movement of the planets, their position in heavens, which through the cosmic influence formulates the shape of events in this material world, which consists of four elements (1) water, (2) air, (3) fire, (4) earth Al-Bīrūnī states that this foundation is possibly trivial There seems to be no direct connection between the two There is no logical justification to adopt it as true (My personal finding is that in practice when the results, verdicts and prognostications are shifted, about fifty per cent of these come out to be true We mathematically eliminate the factor of chance Judgement is still, in favour of astronomy By some cosmic relations, beyond human conception, astrology gives 50 % correct results Otherwise this art if a pure artifice of deception, would have died long ago)

Then al-Bīrūnī goes on to describe that there is a fifth section of astrology in which such fundamental relations of cause and effect is unknown "وهي مجهول له المبادى" (and it is without any foundation of cause) (p 319) Al-Bīrūnī now impresses upon the reader, the cause of weakness of astrology He says "Here astrology reaches a point which threatens to transgress its proper limits, where problems are submitted which it is impossible to solve for the most part, and where the discussion leaves the basis of the material universe, and enters into intricacies of unknown worlds When this boundary is crossed, the astrologer remains behind on one side and you meet the SORCERER who stands on the other side of the boundary The field of the sorcerer is active with omens and divinations, which has nothing to do with astrology, although the sorcerer to hang a coloured curtain, makes references of planets and stars in connection with his verdicts" (P 319)

Al-Bīrūnī has thus also limited the scope, strength and influence of the verdicts of astrology, and at the same time has confined it in the activities of the material universe which is made up of the four elements water, air, fire, earth. The world beyond this material universe, the unexplored world, the spiritual world, the upper world, the internal workings of the human mind are beyond the scope of astrology This is the field of the sorcerer کاهن کہانت and not of astrologer

To come very near the spirit of the meaning of this discussion, we now refer to the words of al-Bīrūnī as narrated by him in the Persian version of *al-Tafhīm al-Najūm*

He describes the first three sections (P 510) of astrology and then states:

و سپس او حال فعلهای آدمیانست اگر ده‌اه ایشان - و این قسم چهارم است
و این همه قسم ها بنا کرد دست بر مبادی و آغاز های که نهاد است آنرا -

اگر با پنجم باشد از پس این (ص ٥١١) پنجم قسمت است - دانش آن حالها با
مجهولی آغازها -

(It means that the basis on which we construct the calculations of astrology to draw conclusions regarding facts and conditions in the fifth section are not known to us) Al-Bīrūnī proceeds

و بدین قسمت صناعت نجوم به آن جای رسد که از حد خویش خواهد بیرون
آمدن و بر او چندان بار نهاده آید که نتوانند کشیدن - و کار از سطری کلمات به غایت
باریکی حروبات رسد - منجمی را از طرفی ماند (مانند) و کاهنی را از طرف دیگر - چون
از آنجا بگذری بمیدان حال و زجه اندر آئی - نه بنجوم - هر چند که بنجوم اندر آن
یاد کرده آید -

To keep my research conscience clear and keeping in view the responsibility of the delicate judgement, I have given the Persian version

I will translate it below for the information of those who do not know Persian This is old Persian which was current in the days of al-Bīrūnī

Translation (PP 510-511)

> "When we reach this fifth section of *Najūm*, the art of *Najūm* reaches a land, in which it can only enter by transgressing its own limits On *Najūm* is placed such a heavy burden, that it cannot carry that The activities of this science from firm fundamentals, reach delicate details of the EXTRAS connected to *Najūm* This resembles astrology on one side and *Kahaut* (the art of divination) on the other When you cross this point you enter the field of *Fālgīrī* **فال گیری** and (some type of art which you are not allowed to practise open to censure, and a threat is issued in Islam to disdain from it) This is not *Najūm* All the same the workers of this Black Art mix in it certain terms and idioms of *Najūm* to give it a graceful appearance ")

However what my inner mind and sixth sense has understood from the words of the great Ustādh, al-Bīrūnī, by a spiritual interconnection I have given my opinion in my words stated above

When we study pages 330-333 of this book, we immediately come to the conclusion that al-Bīrūnī is a practising astrologer, and he knows all the details which confront an astrologer when working out predictions by help of astrology

We may now be allowed to give the opinion of two scholars, regarding the belief of Abū Raihān al-Bīrūnī on the authenticity of the verdicts of astrology

The great scholar Aqā'ī Jalāl Humā'ī, who has edited the Persian edition of *al-Tanjīm* with high credits, states (Page 14 Muqaddimah of Persian edition)

استاد ابو ریحان در این کتاب و دیگر تالیفات خویش همه جا منجمان حشوی و
غیب گویان نجومی را نکوهش کرده و بی عقیدگی خود را با حکام نجوم وسستی و آشفتگی
اساسهای این فن را مکرر تصریح فرموده است - از جمله در ص ۳۱۰ از کتاب تفهیم حاضر
عبارتی بی اندازه لطیف و دلپسند دارد - و نزدیک بیشترین مردمان احکام نجوم ثمرهٔ
علمهای ریاضی است - هر چند که اعتقاد ما اندر این علم و اندر این صناعت مانندهٔ
اعتقاد کمترین مردمان است " و در ص ۳۶۰ دربارهٔ احکام نجوم میفرماید " اصل این
حدیث سستی مقدمات این صناعت و آشفتگی قیاسها است " (ص ۱۵) " در کتاب الاثار
الباقیه نیز هر جا از حکم نجومی سخن بمیان آمده صریحاً بی اعتقادی خوش با حکام
نجوم سستی اساس این فن را گوشزد فرموده - و کتاب التجمیه علی صناعة التمویه را در
موضوع احکام نجوم و کشف تلبیسات و تمویهات و تحقیق در منجمان رز اند - و منجمان
که احکام عالم را با محاسبات غلط و مبادی نا صواب استخراج و تهمت پرستارگان از پیش
خود هده نوع پیشگوئی میکنند تالیف کرده است " (ص ۱۵) (ص ۱۵) " بالجمله
ابو ریحان نجوم و غیب گوییهای منجمان حشوی اعتقادی نبود " -

Translation

In this book and in other works at all places, Ustādh Abū Raiḥān has censured 'Extra Astrologers' **منجّمان حشوی** and prognosticating astrologers He has repeatedly explained his unbelief in the verdicts of astrology, and loose and frail, and perturbed estimations of this art

There is a highly fascinating and fine statement in this book *Tafhīm* on page 310 He says 'And according to the belief of most people, the verdicts of astrology are the fruit of the various branches of mathematics However my belief in this branch of knowledge, and in this art, is like the belief of those people who believe in it least " On page 360, he says regarding the verdicts of astrology "The foundation of this art is placed on frail principles, and perturbed estimations,"

Two other references have been given by Ustādh Humā'ī

> In the book *Athār al-Bāqiah* also, wherever a discussion has arisen regarding the verdicts of astrology, Abū Raiḥām has expressed his clear unbelief in them, and also the frailness of the foundation of this art In the book *al-Tanbih 'alā Ṣana'ah al-Tamwīh* (Admonition for those who indulge in the art of deception and pretention, in the field of astronomy), al-Bīrūnī has given many descriptions in connection with the verdicts of astrology in which the fraud and frailment have been exposed, and true facts in the light of research have been explained He has stated the cases of those astrologers, who determine the verdicts regarding this world by wrong calculations, and wrong principles They prognosticate all kinds of predictions according to their own choice and threw the blame on the Planets)

> Summarising the situation we can say that Abū Raiḥān had no faith in the verdicts and prognostications of 'Extra Astrologers'

Without the following evidence from a great European scholar, our field of investigation will remain incomplete We mean the great scholar Dr Eduard C Sachau, who although a German by mother-tongue, has so successfully translated al-Bīrūnī's Arabic book كتاب في تحقيق ما للهند (*Alberuni's India*) into English

We have taken these extracts from the preface to this book, written by Dr Sachau [19]

> (P X) "Al-Biruni probably enjoyed the reputation of a great *Munajjim*, i e astrologer-astronomer, and it was perhaps in this quality that he had relations to the court and its head, as Tycho de Brahe to the Emperor Rudolf When writing the "Indica" thirteen years after his involuntary immigration to Afghanistan, he was a master of astrology, both according to the Greek and the Hindu system, and indeed Eastern writers of later centuries seem to consider him as having been the court astrologer of King Maḥmūd "

> (P XXXIII) "That he believed in the action of the planets on the sublunary world, I take for certain though he nowhere says so It would hardly be intelligible why he should have spent so much time and labour on the study of Greek and Indian astrology if he had not believed in the truth of the thing He gives sketch of Indian astrology in Chapter LXXX, because Muslim readers are not acquainted with the Hindu methods of astrology, and have never had an opportunity of studying an Indian book" (Translation Part II, Page 283)

An argument strikes my mind, which throws light on the apparent attitude (not internal emotions and tendencies), regarding astrology, adopted by al-Bīrūnī You have never heard an orthodox Mullah, reciting his *Khutbah* in Friday Prayers He comes down like a hilly torrent His cogitations break down all impregnable forts of logic He is not prepared to harmonise with any admitted principles of science or testimony of experiment According to orthodox school of Islam, all such branches of knowledge which foretell, prognosticate or forecast, as they reflect on prophetic powers are placed under strict censure These should not be practised The period of Sulṭān Maḥmūd Ghaznawī (999-1031) seems to be furious in its orthodox zeal Astrology and the like (*Ramal*, *Fāl*, *Shagūn*) are prohibited branches of learning A person who practises or professes these is trodden with heavy weight of orthodox censure Al-Bīrūnī naturally had to disdain from declaring himself openly as a practising astrologer To save his honour he had to refuse the statement that astrology is an efficient or effective or useful art He has not done so in any of his writings That would save him from the censure of the orthodoxy The uncompromising *Mullah* goes to the extent of declaring that the Funeral Prayer (Namāz Janāzah) of such a *mushrik* (one who accepts a co-sharer of God Almighty in His powers) is the greatest sin according to Islamic Code of Faith If censured openly by the orthodoxy, it would become difficult for anybody to complete his burial Al-Bīrūnī was conscious of all these situations

R Ramsay Wright in his translation of Arabic *al-Tafhīm al-Najūm* (P 210) states in the footnote that according to the book of al-Bīrūnī *Chronology* (P 217) "He apparently also shared the general belief in the efficacy of charms and talismans but his contemporary Avicenna is very contemptuous in his refutation of astrologers " (P 210)

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THE EVOLUTION OF COSMOLOGY IN THE HANDS OF MUSLIMS UP TO THE TIME OF AL-BĪRŪNĪ

SYED SIBTE NABI NAQVI

UP TO the time of advent of Islam the progress of cosmology had been extremely slow The ancient cosmologies of the Babylonians, Egyptians and others were extremely fantastic, childish and anthropomorphic interpretations of primitive experiences and limited observations

About 2,000 B C Prophet Abraham (p b u h) revolted against Babylonian polytheistic cosmology, on the basis of revelations, but the Jews during their captivity incorporated that very cosmology in their Old Testament Dreyer has given full details of this on pp 2 and 3 of his *History of Astronomy from Thales to Kepler*

Greeks produced a number of philosophers and astronomers from Thales (640-562 B C) to Ptolemy (90-168 A C) They included Pythagoras, Plato, Eudoxus, Kalippus, Aristotle, Democritus, Herakliedes, Euclid, Archimedes, Aristarchos, Hipparchos and many others They made significant contributions for the advancement of astronomy and mathematics, but their cosmological concepts continued to have elements of fantasy and immature generalisations These have been discussed in the treatise in some detail

Christianity and Judaism were basically opposed to acquirement of knowledge, particularly the ideas developed by pagan philosophers of Greece A Christian mob destroyed the magnificent library of the Alexandrian Museum in 398 A C, and another mob murdered and desecrated the corpse of the most beautiful, virtuous and learned astronomer, Lady Hypatia, to satisfy the pride and cruelty of the Archbishop of Alexandria in 415 A D The idea of the rotundity of the earth was particularly repugnant to the Christian church

The geometric details of the geoheliocentric universe by Herakliedes of the 4th century B.C. or of the heliocentric system proposed by Aristarchos of Alexandria in the third century, or by Seleukas of Babylonia in the second century B C were not worked out In fact, Herakliedes was fond of embellishing his books by tall tales and fantastic stories, and his suggestions carried little weight with serious thinkers Naturally these suggestions were not accepted by philosophers living in the world depending on astronomical observations of the naked eye Pythagorean system was a mixture of some advanced ideas and fantastic mystic theories about numbers and the harmony which ruled the world

On the other hand, the believers in the geocentric systems had produced elaborate geometrical details for satisfying the observed motions of stars and planets

Plato (428-347 B.C) worked his 'Implement of Necessity', with spherical earth at the centre, by a singing horde of sirens and daughters of Fate, Lachesis (past), Klotho (present), and Atropos (future) The sirens sat at the end of lips of whorls of stars and planets, producing the eight notes of harmony The daughters of Fate sat at equal distances from each other on their respective whorls in royal splendour, and sang songs of past, present and future, in harmony to the notes produced by the sirens While Klotho turned the outer spheres (of Sameness) with her right hand, Lachesis turned the inner sphere (of the Diverse) with her left hand Atropos turned either of them with either hand at times The stars were divine bodies made of fire, and the whole cosmos was a work of art, possessing the most godlike of all souls

Eudoxus in his geocentric scheme of homocentric spheres tried to explain the motions of planets and stars by the motions of 27 spheres, 8 of which carried stars and planets Kalippus added 6 spheres to these to remove some lacunas left in the scheme of Eudoxus Aristotle added 22 counter revolving spheres to the 33 of Eudoxus and Kalippus But with all these 55 spheres, the great variation in the brightness of Mercury and Venus could not be explained Aristotle regarded the shooting stars, meteors and auroras to be hot exhalations rising high in the atmosphere Comets were produced in the same way in the highest parts of the atmosphere, on the conjunction of Jupiter with the stars in the Gemini The Milky Way was considered to be a phenomenon of the same kind He considered stars and planets to be spherical, eternal and divine, consisting of the material in which they moved Their physical bodies were made up of either in different states of purity

The real difference in the cosmological concepts of Pythagoras and Plato on the one hand, and Aristotle on the other, was that the former considered the motive force for running an infinite universe to be emanating from the centre, while Aristotle thought that its origin was the ninth sphere, which was the prime mover, surrounding the eight spheres of the material universe

Hipparchos of Rhodes (210 to 129 B C) was the first practising astronomer who took pains in taking observations with instruments in which the circle was divided into 360 degrees He prepared a catalogue of stars in 161 B C and examined the controversy between the heliocentric and geocentric systems objectively Although he believed in epicycle and eccentric circles, he came to the right conclusion that the observational data at his command were not enough to give a conclusive result

About two hundred years after him was Ptolemy (90-168 A D) He started his astronomical observations in 127 A D , and continued them without break up to 151 A D Sarton has termed him to be a poor observer However, he prepared a catalogue of 2028 stars in which his own observations of 24 years, and observations of unequal correctness and significance of Hipparchos and others of Alexandria and Babylonia were included These extended back to 161 B.C and contained observations of about 58 years in all Then he wrote *Almagest*, which was a compendium of ancient astronomy and in which the astronomical and mathematical knowledge available to him was carried to its very limits In this book he finally established the geocentric hypothesis by using epicyles, eccentrics and equants His theory was generally accepted by the astronomers and mathematicians, and even by the common man so much so, that even the beliefs of the Christian Church were affected by it to some extent It was such a step forward that practically no advance was made on it by any pagan, Christian or Jew astronomer for about 500 years, till the emergence of Islam It was not a cosmology in the strict sense of the word, but only a geometric device to compute the positions of the sun, moon, and the planets, but the geocentric system propounded by him was really a cosmological concept of far reaching importance

Prophet Muḥammad (p b u h) started receiving revelations in 610 A D These continued for twenty-three lunar years, up to about 632 A D These were arranged in the form of the Holy Qur'ān by the Prophet (p b u h) himself The Qur'ān is silent about the system being geocentric or heliocentric, but it makes a clear statement that both the sun and moon are in motion, and the cosmological concepts are spread over the whole Book These are summed up in the following Chapters (Surahs indented in Roman numbers) and verses indicated in Arabic numerals) —VI XI 7, XXI 30, XII: 9 to 12 XXII 47, LXX· 4, XXI 105 The Qur'ānic cosmology based on the above verses is summarised below

'Allah, who is Omni-present, Omni-scient and Omni-potent, brought into being Darkness (Continuum) and Light (the Photons), and all other elementary particles This was a closed up mass (The Yelm) He began to open out this closed up mass at a particular moment in Truth (الحق) in accordance with the requirements of wisdom The expanding mass has passed through six cosmic periods of evolution (Days) in three stages of two cosmic periods (Days)

each, which are as follows

(1) Creation of matter in the form of gas at high temperature, its coolin and break upto into galactic masses, further break up of the galact c masse into stars and planets, i e birth of earth in two days

(2) Formation of mountains on the surface of the earth and production o food materials (compounds) in abundance for all seekers alike in two days I this stage living cells began to develop in black mud altered, and in water, and th throne of authority of the Lord (العرش) was on water to prove which one wa best in conduct

(3) Perfection of man, and conferment of higher degrees of freedom (Lor breathing His Spirit into him) on him, to enable him to acquire knowledge, an creation of seven heavens one above the other, without any material suppor and fixing their duties and commands, in the last two days The heavens a thus only fields for the play of capacities of man in higher degrees of freedon beyond the first heaven which has been decorated with lights of galaxies an stars, and for which he makes himself capable by good actions in this life

On approach of the Day of Resurrection, the heavens and the earth will l rolled up like the rolling up of a written scroll by a scribe The whole proce will be repeated again This is a promise by which God has bound Himse in the Qur'ān

This cosmology of the Qur'ān is the briefest possible description, in popul language, of an evolutionary, pulsating universe, as we understand it toda in the last half of the twentieth century Such a cosmology had never be propounded by any philosopher or astronomer before, but the miracle of tl Qur'ān was that it could be appreciated with aesthetic delight by the wanderi Bedouins of the desert, by the learned philosophers of the Middle Ages, also by the cosmologists of the 20th Century

It could, evidently, not be properly understood by even the most learn scientist in the Middle Ages However, it goes to the credit of the Musl learned men like al-Ma'mūn, al-Kindī, al-Khwārizmī, al-Rāzī, al-Ghazzālī, Il Maskawayh, Ibn al-Haitham, al-Bīrūnī, Ibn Sīnā, Ibn Rushd, Naṣīr al-Dīn Ṭūsī, and others, that instead of corrupting and changing the verses of the Qur' like the followers of earlier religions, each one of them concentrated his effo in his own way, freely, in trying to understand the meanings of these verses, an objective manner, in keeping with the injunctions of the Qur'ān itself Th instead of putting themselves in the maze of primitive anthropomorphic riddl they opened the way for unhindered progress of science and civilization

They made acquirement of knowledge universal and international Th adopted special symbols for numerals from 1 to 9 and introduced zero f

regular use in their decimal system of numeration, and developed arithmetic to the status of a regular science, algorism from al-Khwārizmī, and above all, they introduced empirical inductive method of research For elucidation of this statement you may see Drapers *"Conflict between Science and Religion"* or my book *" Islam and Contemporary Science "*

They translated the scientific, philosophic, mathematical and astronomical works in Sanskrit, Pahlawi, Syriac and Greek for understanding the cosmological statements and astronomical allusions in the Qur'ān (vide Appendix I)

They improved and invented equipment for taking most accurate observations and developed theory to fully appreciate their meanings and implications (vide Appendix II)

Unlike their predecessors before Hipparchos, they kept regular record of their observations in the form of tables and catalogues, for 500 years from 767 to 1276 and later, and published them for the benefit of all others interested in the subject (vide Appendix III)

After examining the astronomical systems of Indians, Iranians (in the Babylonian tradition) and all the various systems proposed by the Greeks, (Pythagoras, Plato, Eudoxus and Kalippus, Aristotle, Herakliedes, Aristarchos and Ptolemy) they selected the Ptolemaic system, which was the most advanced amongst them all, as the starting point of their research towards the middle of the eighth century They began to reject it and started search for a new and better system before the end of the 12th Century, actually in the 11th Century From a study of the cosmological concepts of al-Bīrūnī it is clear from *Kitāb al Tafhim li al-Awā il al-Tanjīm* (Sections 120 to 345) that he was fully aware of the connection between movements of the planets and the sun and of the heliocentric system, but he was not convinced of the usefulness of this system in preference over the geocentric system I think the real difficulty in his way was that the Holy Qur'ān stated that the sun was moving towards a goal, but the heliocentric system wanted it to be stationary at the centre The question of the procession of the equinoxes was still undecided and remained undecided for four centuries after him This matter could be clearly decided after the movement of the sun round the cen re of our galaxy was settled on the basis of regular and accurate observations started by the Muslims themselves

Up to the time of al-Bīrūnī, and even afterwards, great masses of people believed in the efficiency of astrology, but the Qur'ān, and the Prophet (p b.u h) like a true scientist, were against it Al-Bīrūnī learnt astrology of the Greeks, Hindus and Iranians, but at the end came to the conclusion that it was without much reality In the last para of Section 346 of *Tafhim*, he says, "And now it is time to deal with the expressions which the astrologer

uses with regard to the decrees of stars, and which are of interest to querents By the majority of people the decrees of the stars are regarded as belonging to an exact science While my confidence in their results and in the profession resembles that of the least "

This shows his scientific spirit and honesty, to which I pay homage

Appendices I to IV to the Book "*Advances of Cosmology and Astronomy by Muslims in the Middle Ages*", in two parts of which the present paper "Evolution of Cosmology in the hands of Muslims upto the time of al-Bīrūnī" is a summary of Part I

APPENDIX I

Works translated into Arabic with names of translators (T), Commentators (C) and abstractors or elaborators (AE) or criticisers (CR)

1 *Siddhants*. Sanskrit, math and astronomy (V-A D) (T) Muḥammad ibn Ibrāhīm al-Fazārī (772/73) (AE) Ya'qūb ibn Ṭāriq (773-778), Ibn Samān (979-1035), Ibn al-Ṣaffr of Cordova (قرطبة)

2 *Vaharamihira* Sanskrit (fl 505 A D)—(T) Al-Bīrūnī (d 1048) two books

3 *Pahlawi works* on astronomy (T) Al-Faḍl ibn Naubakht (d. 816) & his two sons 'Umar ibn Farḥān and Abū Hafz ibn Farḥān (d 817)

4 *Leucippos* (V B C) Atomist Philosopher 'Alī al-Ṭaiyibī al-Baqīlānī (d 1013) introduced in Kalām the ideas of atom and void and conceiving time and motion essentially discontinuous Introduced the idea of atomism of Time and Motion

5 *Plato* (IV-1 B C): Philosopher, mathematician (T) Timaeus Yaḥyā ibn Baṭriq (813-833) (C), (*Republic*) Ibn Rushd (1126-1198)

6 *Aristotle* (IV-2 B C) Encyclopaedist, philosopher, founder of Logic (T) Yahyā ibn Baṭriq (813-833), 2 Isḥāq ibn Ḥunayn (d 910/11), Thābit ibn Qurrah (826—901), 3 Abū Sa'īd ibn Ya'qūb al-Damishqī (908-932) (C): Al-Fārābī (770-850/857) 2 Ibn al-Haitham (965-1039), 3 Ibn Bajjā (1106-1138) 4 Ibn Ṭufail (1100-1183), (AE) Ibn Rushd (1126-1198)

7 *Autolycos* (IV-2 B C): Mathematician (spherical geometry), astronomer (T) Isḥāq ibn Ḥunayn (d 910/11) 2 Qusṭā ibn Lūqā (d 912) (Christian), (AE) Naṣīr al-Dīn al-Ṭūsī (1201-1274) wrote one of the Mutawassiṭats

8 *Euclid* (III-I B C.) Mathematician (Elements books I-X), physicist: (T). Ḥajjāj ibn Yūsuf ibn Maṭar (786-833), 2 Isḥāq ibn Ḥunayn (d 910/11) 3 Thābit ibn Qurrah (826-901) 4 Hāfiz ibn Yumān (d 990) Christian 5 Al-Damishqī (908-932) 6 Ibn Sīnā (980-1037) 7 Naṣīr al-Dīn al-Ṭūsī (1201-1274) (C) Jābir Ibn Hayyān (754-776) from Greek text 2 'Abbās ibn Sa'īd al-Jauharī (813-833) 3 Al-Māhānī (860-872/84) 4 Al-Nairizī (892-902), 5 Qusṭā ibn Lūqā (d 912) Christian 6 Abū al-Wafa (940-997) 7 Abū Ja'ffar al Khazinī (Book X) (d 961/971) 8 Muḥammad ibn 'Abd al-Bāqī (on Book X) (fl 1100-1123) (AE) Ḥajjāj ibn Yūsuf ibn Maṭar (829) notes and additions 2 Abū Ḥātim al-Asfazārī (d 1122) summary of Books I to XIV 3 Ibn Labudī (1210-1267)—Essential points extra, explanation of postulates, 4 Abū' al-Farāj, Christian (1268) lectures (AE) 5 Ibn al-Bannā (1256-1321) introduction 6 Naṣīr al-Dīn al-Ṭūsī (1201-1274) (a) for Mutawassiṭats (M) (b) on Euclid's postulates (c) on postulate No 5 (start of non-Euclidian geometry) (d) longer re-edition with notes and additions

9 *Aristarchos* (III-1 B C), Astronomer who suggested heliocentric system (T) Qusṭā ibn Lūqā (d 912) (AE) Naṣīr al-Dīn al-Ṭūsī (1201-1274) Books for Mutawassiṭat

10 *Archimedes* (III-2 B C). Mathematician, physicist (T) 1 Isḥāq ibn Hunayn 2 Thābit ibn Qurrah 3 Yūsuf ibn al-Qaṣṣ (902-908) 4 Naṣīr al-Dīn al Ṭūsī (C) 1 Al-Māhānī 2 al Naṣawī on Lemnata (AE) 1 Al-Māhānī made advances on Archimedes, 2 Ibrāhim ibn Sinān (908-996) simplified Quadrature—His solution simplest up to invention of integral calculus 3 Rustam al-Kūhī (fl 988) devoted special attention to his problems 4 Al-Naṣawī on Lemnata, 5 Naṣīr al-Dīn al-Ṭūsī for M

11 *Apollonios* (III-2 B C). Mathematician– 8 books on Conics (T) 1 Ḥilāl ibn Himṣī (d 833) 2 Thābit ibn Qurrah 3 Abū al-Fatḥ al-Isfahānī (fl 982) 4 Naṣīr al-dīn al-Tūsī—Revised T of 1 and 2 for books 1 to 7 (C) Ibrāhīm ibn Sinān (908/9-943) on book 1 2 Abū al-Fatḥ al-Iṣfhānī on books 1 to 5 (AE) Rustam al-Kūhī (fl 988) devoted attention to his problems 2 'Abd al-Malik al-Shirāzī (xii-2 A D)—A Summary of Conics 3 Naṣīr al-Dīn al-Ṭūsī (1201-1274) book for M

12 *Hypsicles* (II-1 B C) Mathematician, wrote Euclid book XIV—divided into 360 paras. (T) 1 Isḥāq ibn Ḥunayn (d 910/11) 2 Qusṭā ibn Lūqā (d 912) Christian (AE) Naṣīr al-Dīn al-Ṭūsī wrote for M Abū Ḥātim al-Asfazārī (d 1122) A summary of book XIV along with all other parts of Euclid's Elements

13 *Hipparchos* (II-2 B C). Astronomer, mathematician, used circles divided into 360° for astronomical observations, compiled a catalogue of 850 stars used by Ptolemy in *Almagest* along with his epicycles and eccentrics

14 *Theodosios* (I-1 BC): Mathematician, spherical geometry, 3 books 1 on Spherics 2 on Days and Nights and 3 on Habitations (T) Thābit ibn Qurrah (2) Qusṭā ibn Lūqā (AE) Naṣīr al-Dīn al-Ṭūsī for M

15 *Heron of Alexandria* (I-1 B C) Physicist (T) 1 Qusṭā ibn Lūqā

16 *Menelaus* (I-2 A C) Mathematician—Spherics—area of triangles in functions of sides—astronomer—(T) 1 Isḥāq ibn Hunayn (d 910/11) 2 Thābit ibn Qurrah improved 1 3 Abū Naṣr Manṣūr ibn 'Alī ibn 'Irāb (1007/8)—an improved edition, 4 Al-Ṭūsī (1201-1274) a new addition of 3 5 Al-Māhānī (853-874/84) improved 1 and 2 (AE) 1 Al Naṣawī (fl 1029-30) on Menelaus's theorem 2 Al-Ṭūsī (1201-1274) wrote for M

17 *Ptolemy* (II-2 A C) Mathematician, astronomer, geographer, made observations for 24 years, but a poor observer—Great theoretician Wrote *Almagest* (on math and astr) *Quadripartitum* on trigonometry (T) 1 Hajjāj ibn Yūsuf ibn Maṭar (829) from Syriac 2 Rabbān ibn Sahl al Ṭabarī (Jew) (fl beginning IX A C) from Greek 3 Isḥāq ibn Hunayn (d 910/11), 4 Thābit ibn Qurrah (826-901) 5 Yaḥyā ibn Baṭriq (754-796) Al-Manṣūr's translator 6 Hunayn ibn Isḥāq al-'Ibādī (800-861) translated *Quadripartitum* (C) Jābir Ibn Hayyān about (754-776) from Greek text, 2 Abū al-Ḥasan ibn 'Alī al-Ṭabarī (775-861) on complicated problems of *Almagest* 3 ' Umar ibn al-Farrukhān al-Ṭabarī (815) on *Quadripartitum* 4 Aḥmed ibn al-Miṣrī (d 833) on centiloquium and a book on proportions, 5 Al-Nairīzī (892-902), Al-Fārābī (870 950/51) on *Almagest* 8 Ibrahīm ibn Sinān (908/9-943) on *Almagest* 8 Al-Battānī (858-929) commentary on *Tetrabiblon* 9 Maslamā ibn Aḥmed al-Majrīṭī (died about 1007) on *Planisphærium* (AE&C) 1 Al-Khwārizmī (d 850) improved Ptolemy's geography 2 Al-Farghānī (831-861) wrote an abstract of *Almagest* 3 Al-Battānī (858-929) found that long of sun's apogee has moved since the time of Ptolemy by 16″ 47°, discovered solar apsides and a slow variation of equation of time, found precession 54 5″/ year, inclination of ecliptic=23″ 35° 4 Abū al-Wafā (940-997/998) wrote *Kitāb al-Kāmil*, a simplified version of Almagisti which is extremely thorough and comparable to *Almagest* itself 5 'Abd al-Jalīl Sijistānī (951-1029) rejected Ptolemy's system and gave a heliocentric system 6 Ibn Ṭufayl (1100-1185/86) gave advice to Ibn Rushd and al-Biṭrujī against Ptolemaic system and the modification of system of homocentric spheres 7 Ibn Bājjā (1106-1138) criticised Ptolemaic assumptions 8 Ibn Rushd (1126-1198) wrote a summary of *Almagest*, rejected epicycles and eccentrics and advised al-Biṭrujī about modifications in homocentric signs, 9 'Abd al-Mālik al-Shīrāzī (XII-2) abridged *Almagest* 10 Ibn Ṭufayl (1100-1185/86) against Ptolemaic system and suggested its modification to al-Biṭrujī 11 Jābir ibn Aflāḥ (XII-2 and XIII-1) He criticised Ptolemaic theory of planets vigorously and wrote *Islāh Almagisti* (Improvement of Almagest) 12 Al-Hasan al-Marrakeshī (fl 1262)—developed very much the graphical methods

of solving astronomical problems which had become much more important on introduction by Muslims of planispheres, improved astrolabes, and new instruments like quadrants, sextants, etc, needs of gnomonics had also much increased since the time of Ptolemy– while Ptolemy had only touched these graphical methods in his *Annalema* 3 Abū al-Farāj (Christian) Summary of lectures delivered at Maragha on *Almagest* in 1272/73 14 Naṣīr al-Dīn al-Ṭūsī (1201-1274) (a) wrote a book on *Almagest* for M (b) In Tadhkirah written before 1256 in Chapter 2 These criticized *Almagest* with regard to anomalies of the moon, motion of planets in latitude (notably Mercury and Venus) and proposed a new system to replace the complicated Ptolemaic system of eccentrics and epicycles In this he showed considerable ingenuity and obtained oval shaped orbits of planets His new and forceful criticism was an additional step towards the emergence of heliocentric system of Kepler 15 Thābit ibn Qurrah (826-901) added 9th sphere to Ptolemy's 8

18 *Diophantos* (III-2 A C) Mathematician [Algebra] (T) Qusṭā ibn Lūqā (910/11)

19 *Pappos* (III-2 A C) Geometrician with new ideas (T) Al-Damishqī (d 932) P's Com along with Book X of Euclid's Elements

20 *Eutocios* (VI-1 A C) Mathematician, wrote books I to IV of *Conics* and XV of Euclid (T) Thābit ibn Qurrah (d 901) (AE) Nasīr al-Dīn al-Ṭūsī (1201-1274) for M

21 *Deplantis* (Pseudo-Aristotleian) (T) Isḥāq ibn Hunayn (d 910/11)

22 *Many Greek Scientific Works* (T) by translators of Khālid ibn Yazīd—704-708

23 *Many Greek Scientific Works* (T) by al-Kindī (800-873)

24 *Two books of Varahamihira* (fl 505 A C) (T) al-Bīrūnī (973-1048)

APPENDIX II

Astronomical Instruments used at different times up to the 14th century, and the Books on their construction and use in Arabic

1 *Gnomon*—In use up to 3,000 B C

2 *Sundial*— brought into use in Greece about 550 B C

3 *Sundial* -improved about 250 B C

4 Circle divided into 360° about 130 B C

5 *Diopter*—Earliest mention for use in surveying 210-129 B C

6 *Universal Sundial*—Invented at start of 1st century B C

7 *Celestial capula and celestial hemisphere* made in China, 79-139 A.C.

8 *Parallactic scales* } used by Ptolemy 127-168 A C
9 *Meridional instruments* }

10 *Astrolabe* Earliest book written in Greek in first half of 6th century A C

11 *Astrolabe* First book written in Arabic by a Christian 660 A C

12 *Astrolabe* First book written in Arabic by Jābir Ibn Ḥayyān

13 *Astrolabe* improved to read up to a degree by al-Fazārī

14 *Armillary sphere* constructed by al-Fazārī

15 *Quadrants capable of reading correct to a minute* or less 813-833

16 *Sextants capable of reading correct to a minute* or less 813-833

17 *Improved astronomical and surveying instruments* of al-Kindī 813-876

18 *Spherical astrolabe*—a universal instrument 855-900

19 *Astrolabes* capable of reading correct to a minute or less 813-833

20 *Pin-hole camera* by Ibn al-Haitham (905-1039)

21 *Vernier like device* invented by Ibn Sīnā (when at Hamadan between 1000 and 1037)

22 *Safīha*—an improved astrolabe invented by Zarqālī (1029-1087)

23 *Tusi's staff*—a linear astrolabe invented by Muzaffar Ṭūsī (d 1213)

24 *Turquet*—Two graduated circles at right angles to each other, Naṣīr al-Dīn al-Ṭūsī (1258-1274)

15 different kinds of Quadrants used by the Muslims

(a) *Musaṭṭah Quadrant*
(b) *Sufficient Quadrant*
(c) *Dastūr Quadrant*
(d) *Sine Quadrant*
(e) *Quadrant of hidden sines*
(f) *Quadrant bearing projections of parallels of latitude (circles of altitude)*
(g) *Rub Al-Tamm*
(h) *Rub Al-Jāmi'*

I Instruments used by Arab astronomers given in an encyclopaedic treatise written for Alphonso X of Castile (1252-1285) in Spanish

1 Equitorial, ecliptic and horizontal armils—The armil being a universal instrument

2 Spherical astrolabe- also a universal instrument

3 Plane astrolabe

4 Atazer— a plane astrolabe with an alidade

5 Universal plane

II List of instruments in use at the Maragha Observatory (1259-1274) given by al-'Urudī in his treatise

1 Mural quadrant

2 Armillary sphere

3 Solistical armil

4 Equitorial armil

5 Hipparchos's diopter (alidade)

6 Instruments with two quadrants

7 Instruments with two limbs

8 Instruments to determine sines and versed sines

9 Instruments for determining sines and azimuth

10 The perfect instrument (built by al-'Urudī) a universal instrument

11 Parallactic rulers (after Ptolemy)

12 Turquet (invented by Nasīr al-Dīn al-Ṭūsī) a universal instrument

13 Astrolabes (perhaps both plane and spherical)

14 Sextants

III Books on astronomical instruments, their construction and use, written in Arabic from 7th to 14th centuries and some part of 15th century By 27 authors—By 1 in 7th and 8th century each, by 2 in 9th and 10th centuries each, by 6 in 11th century, 1 in 12th century, 3 in 13th century, 7 in 14th century and 6 in the beginning of 15th century

APPENDIX III

Astronomical tables and catalogues based on actual observations from earliest times up to 14th century

S No	Period for which valid	Place of observation	Particulars of table or catalogue with name of compiler
1	193-190 B C	Alexandria	Egyptian Papyrus
2	161 B C		Earliest observations used by Ptolemy
3	129 B C	Rhodes	Catalogue of 850 stars by Hipparchos
4	137 B C	Alexandria, Rhodes, Babylonia	Catalogue of 2028 stars by Ptolemy
5	161BC-161AC	Alexandria, Rhodes, Babylonia	Almagest used by Ptolemy containing all observations from 161 B C
6	767-778 A C	Baghdad	Tables based on Siddhants by Ya'qūb ibn Ṭāriq
7	825-835 A C	Baghdad	1 Tables based on Siddhants (2) tested tables and (2) Tables of Shah by Ḥabash Hāsib—Tables for tangents included
8	829-833 A C	Baghdad and Damascus	al-Ma'mūnic tables
9	850 A C	Baghdad	al-Khwārizmi's tables—Sine and Tan —functions given
10	877-890 A C	Jundishapur	Comprehensive tables by al-Nahāwandī
11	880-881 A C	Baghdad	al-Baṭṭānī's catalogue of fixed stars
12	892-900 A C	Baghdad	Al-Nairizī's tables prepared for al-Mutadid
13	897-929 A C	Baghdad	al-Baṭṭānī's tables, these contain the catalogue given at No 11 above astronomical co-efficients of great accuracy and tables of trigonometric functions, sines, tangent and cotangents

S. No	Period for which valid	Place of observation	Particulars of table or catalogue with name of compiler
14	885-933 A.C.	Baghdad	Four tables (1) The pure, (2) girdled, (3) The wonderful (4) Tables of Mars by Banū Amajūr
15	900-901 A C	Baghdad	Hārūn ibn 'Alī's tables
16	before 901 A C	Baghdad	Thābit ibn Qurrah's solar observations
17	900-921 A C	Baghdad	Abū Ḥamid al Ḥijāzi's tables
18	900-921 A C	Baghdad	'Abd al-Raḥmān al-Ṣūfī's (903-986) Book containing catalogue of fixed stars as well as illustrations
19	920-921 A C	Baghdad	Niẓām al-'iqd by Ibn al-'Adamī and his pupil
20	920-921 A C		Ibn al-'Ālam's (d 985) tables based on very accurate observations
21	940-997 A C	Cairo	Abū al-Wafā's table—Zīj al-Wāḥid
22.	990-1007 A C	Cairo	Hikamite tables by Ibn Yūnus
23	1007 A C	Cairo	Al-Khwārizmī's tables (8) brought up to date by Maslamā al-Majrīṭī
24	1035 A C	Cordova	Ibn Ṣaffār—tables based on Siddhantas
25	1035 A C	Spain	Abū al-Qāsim al-Aṣbagh, tables based on Siddhanta.
26	1061-1087 A C	Toledo	Al-Zarqālī's Toledoic tables
27	1115-1121 A C	Marw	Zīj al-Mu'tabar al-Sanjar by al-Khazīnī giving positions of stars for 1115-1116
28	1094-1174 A.C		Abū'-l-Barakāt's tables

S No	Period for which valid	Place of observation	Particulars of table or catalogue with name of complier
29	1117-1131 A C	Palace of Saljuq King	Maḥmūdic tables by al-Baladī al-astrolabe in 1129/30
30	1138-1139 A C		Al-Marwazī's conjunctions and periods of planets
31	1145-1175		Zīj Muḥammad by Ibn Abī Barakāt computed in 1266-1285
32	1210-1267		Ibn al-Lubudī's tables
33	1259-1272	Maragha	Il-Khānic tables by Naṣīr al-Dīn al-Ṭūsī covering the period 161 B C to 1272 A C
34	1272 A C	Toledo	Alphonsonian tables by Juddah ibn Moses and Isamy ibn Sid
35	1276	Samarqand	Zīj al-Khāqānī—Il-Khānic tables extended on the basis of Samarqand
36	1240-1311	Milan Antwerp	Henry Bates based on his own observations
37	1301-1350	Damascus	Tables compiled by al-Karakhi based on his observations
38			Ibn al-Kamāl compiled 3 tables based on Toledoic tables
39	1320-1437		Joseph Ben Isauq ibn Waqar (Spanish Jew) fl (1355-1375) compiled tables in Arabic in 1357-58 for latitude of Toledo
40	1360		'Alī ibn 'alī al-Qusṭanṭānī wrote a poem with tables
41	1378-1408	Damascus	Al-Khalīlī al-Muadhdhin on 1378 elaborate tables on the pattern of al-Marākashī
42	1362		'Atā ibn Aḥmad wrote an astronomical treatise with tables

APPENDIX IV

Original Books in Mathematics and Astronomy written in Arabic

I	Seventh Century A C	1 Severus Sebokht (ch)	1
II	Eighth Century A C		
	1	Ibn Naubakht—Astronomy	1
	2	Māshallah—Astronomy and astrology	1
	3	Jābir ibn Ḥāyyān—Astrolabe	1
	4	Ya'qūb ibn Ṭāriq —(I) Saddhamic tables (2)	3
	5	Faḍl ibn Naubakht—Iranian astronomy	(5)
		Total	11
III	Ninth Century A C		
	1	Al-Kindī wrote 270 books dealing with mathematics, astrology, physics, music (2) medicine, pharmacy, geography, geometrical and physiological optics (1), tides, Arabic numerals (4)	270
	2	Abū Sa'īd Darīr al-Jurjanī—(1) geometry (2) drawing meridian	2
	3	Banū Mūsā—many math,, mechanical and astronomical most important being Balana 1, measurement of sphere 1, arith, 1	6
	4	Ḥabash, at Ḥāsib, many, 5 well known say	(50)
	5	'Umar ibn Farhān	1
	6	Al-Khwārizmī	4
	7	Al-Farghānī	1
	8	Al-Dināwarī many astrocal + mathcal books + tables say	(10)
	9	'Umar ibn Farrukhān many — 1 named say	(10)
	10	Abū 'Uthmān Sahl ibn Bishr (Jew) on astrology	1
	11	'Abu 'Ali al-Khayyāṭ many astrological treatises say	(5)
	12	Abū 'Abd Allah al-Mahaue	1
	13	Thābit ibn Qurrah	4
	14	Ibrāhim al-Daya al-Miṣrī	2
	15	Al-Nairīzī	2
	16	Ḥunayn ibn Isḥāq	3
		Total	332

IV Tenth Century A C

1	Qusṭā ibn Lūqā (Christian)	1
2.	Al-Battānī .	1
3.	Al-Fārābi many treatises on physics, music, meteorology, logic	(10)
4	Ibn al-Adamī	1
5	Shujā' al-Ḥāsib al-Miṣrī, algebra	1
6	Rabi ibn Zayd (Christian) some on astronomy	(2)
7	Al-Balkhī—math , astrology, geography	3
8	Muḥammad al-Ḥijāzī	2
9	Ibrāhim ibn Sinān many books on geometrical and astronomical	(5)
10	Al-'Imrānī many treatises on algebra, astrology 1+many	(5)
11	Al Hamadānī ibn al Ḥayq	2
12	Sinān ibn Thābit, various mathematical and astronomical treatises .	(5)
13	Muṭahhar ibn Ṭāhir al Muqdisī .	1
14	Ibn 'Abd Allah Md al-Khwārizmī	2
15	Abū al-Farāj—Fihrist of Books up to 1009 .	1
16	'Abd al-Raḥmān al-Ṣūfī	1
17	Abū al-Wafā (one on astronomy complete book simplified *Almagest*) .	(6)
18	Al-Khujandī	2
19	Maslamā al-Majrīṭī	4
20	Al-Qabisi, astrologer	1
21	Abū J'afar al Khāzin a no of math and astro treatises	(5)
	Total	58
	say	60

V Eleventh century A C

1	Ibn Sīnā/encyclopaedist on all subjects, many times say	(50)
2	Al-Bīrūnī	5
3	Ibn Maskawayh, many books say	(50)
4	'Abd al-Jalīl Sijzī .	3
5	Abū Naṣr Manṣūr ibn 'Irāq—many books, 4 mentioned say	10
6	Ibn Ṭāhir al-Baghdādī—many books of which 2 mentioned say	(5)

7	Ibn Yūnus—compiler of Ḥikamite tables .	.	4
8	'Alı Ibn Rızwān al-Miṣrī—many treatises	say	(10)
9	Abū al-Qāsım Aṣbagh ıbn Samah		5
10	Al-Baqīlānī (Atomism of time and motion)		1
11	Ibn abı Rıjāl al-Maghribī		1
12	Ibn al-Haitham—many risalās besides 2 big books		(10)
13	Abū al-Ḥasan Kushyār ıbn Labbān ıbn Balakhıshjilı	.	5
14	Abū J'afar Muḥammad Ibn al-Ḥasan		3
15	Abū Jūd Muḥammad Ibn al-Layth		3
16	Al-Karakhī		2
17	Al-Naṣawī		3
18	Al-Ghazzālī—many books		(10)
19	Ibn Sa'īd al-Andalūsī		2
20	Al-Zarqālī		2
21	Yūsuf al Muṭamın of Banū Hūd		1
		Total	184

VI Twelfth Century A.C

1	Umar Khayyām—many treatises but enlisted only		4
2	Muḥammed Ibn 'Abd al-Bāqī		1
3	Ibn Bajjā—many treatises on 7 subjects	say	(15)
4	Al-Khazīnī, books named only		2
5	Abū Ḥātım al-Asfazārī		2
6	Abū al-Salṭ various treatises on 3 subjects and on astrolabe	say	5
7	Maimonides (Jew) wrote books phil medicine, astr		34
8	Hibbat allah ıbn Malaka, books on 6 subjects		6
9	Abū al-Qāṣım al-Badī' al Asṭurlābī		1
10	Al-Murwazī		3
11	'Adnān al-Amzarbī		1
12	Ibn Ṭufayl		2
13	Ibn Rushd		96

14	Al Biṭrūjī	1
15	'Abd al-Malik al-Shīrāzī	2
16	Muḥammad Ibn al-Ḥusayn	2
17.	Abū al-Barakāt Hibatullah ibn Malaka al-Baladī, many ..	(5)
18	Abū Naṣr Samuel ibn Yaḥyā al Maghribī .. .	3 or 5
19	Abū 'Abbās Aḥmed al-Kamāl . . .	1
	Total	146

VII Thirteenth Century A C

1	Al Rāzī a very large no of books of which a few mentioned say	(100)
2	Muḥammad al-Hassār .	1
3	Jābir ibn Aflāh	3
4	Al-Bīrūnī	1
5	Ḥasan al-Marākashī	3
6	Ibn al-Badr ..	1
7	Al-Muzaffar al-Ṭūsī	4
8	Abū al-Farāj (Christian)	2
9	Kamāl al-Dīn ibn Yūnus	11
10	Qaiṣaṣ ibn abi al-Qāsim	1
11	Ibn al-Lubudī	8
12	Solomon of Basra (Christian)	2
13	Abū al-Ṭāhir Ismā'īl al Numayrī al Maridīnī	2
14	Muḥammad al-Fārizī .	2
15	Naṣīr al-Dīn al-Ṭūsī	64
16	Al-'Urudī .	5
17	Mūhī al-Dīn al-Maghribī ..	15
18	Shams al-Dīn Muḥammad al-Samarqandī	8
	Total	233

VIII Fourteenth Century A C

1	Abū al-Kāmıl al-Mıṣrī	1
2	Ibn Banna	8
3	John of Erzınjan (Christıan)	1
4	Quṭub al-Dīn al-Shırāzī	17
5	Joseph Ben Joseph Nabshıas (Jew)	1
6	'Abd al-Azīz al-Huwayrī	1
7	Muḥammad ıbn al-Jazālī	3
8	'Abū 'Abd Allah Muḥammad Ibn al-Raqqām	5
9	Naṣīr al-Dīn Mohd ıbn Sam'ān, varıous treatıses	5
10	Al-Karakhī	1
11	Al-Abharī	1
12	Al-Kāshānı (one very long book of 30 chapters)	5
13	Shams al-Dīn Mıruk	4
14	Al-Jaghmānī	3
15	Aḥmad Ibn 'Uthmān al-Jūzjānī, many but 1 mentıoned	5
16	Kamāl al-Dīn al-Fārısī	4
17	'Alā al-dīn ıbn al-Shāṭır	12
18	Ibrāhım al-Hāsıb al-Wārısı	1
19	'Ata ıbn Aḥmed al-Samarqandī	1
20	'Abd al-Wāhıd ıbn Muḥammad	3
21	'Abd al-Qādır al-Ṣūfī	1
	Total	81

IX Fıfteenth Century about those contınuıng from 14th

1	Abū Zayd 'Abd al-Raḥmān al-Jadārī	3
2	Muḥammad ıbn 'Alı al-Jabrāṭī	3
3	Taqī al-Dīn al-Hambalī	1
4	Shıhat al-Dīn abū al-'Abbas Aḥmad al-Faraḍī at least	3
5	Tabugh called Ibn al-Madjī	26
6	'Abd allah ıbn Khalīl al-Marıdīnī al-'Irāqī	5
	Total	41

X Summary of all the original works from 750 to about 1450 in Arabic language

No	Century A C	No of authors in Arabic Persian				No of books written by		
		Muslims	Chris.	Jews	Total	Muslims	Non-Muslims	Total
1	7th Century	0	1	0	1	0	1	1
2	8th Century half	5	0	0	5	11	0	11
3	9th Century	15	0	1	16	331	1	332
4	10th Century	20	1	0	21	56	2	68
5	11th Century	21	0	0	21	184	0	184
6	12th Century	18	0	1	19	112	34	146
7	13th Century	16	2	0	18	229	4	233
8	14th Century	19	1	1	21	79	2	81
9	15th Century half	6	0	0	6	41	0	41
Total of 7 cen (2) to (9) above		120	4	3	127	1043	43	1086
Average per century		17	0 6	0 4	18	149	6	155
Per cent contribution from 7th to 15th centuries (first half)		95%	3%	2%		96%	4%	

AL-BĪRŪNĪ AS AN ASTROLOGER

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THE 11th Century has been described as the golden time of Muslim culture and as the climax of mediaeval thought, because it is in this century that the establishment of the orthodox faith opened a new era of independent research and investigation

Al-Bīrūnī is considered as one of the most outstanding figures of this century, so much so that George Sarton in his "*Introduction to the History of Science*", styles the first-half of this century as the "Time of al-Bīrūnī" He further comments "He was one of the greatest scientists of Islam, and all considered, one of the greatest of all times"

Al-Bīrūnī must rank high in any list of the world's great scholars and scientists No history of mathematics, astrology, astronomy, geography, anthropology, or religion is complete without the acknowledgement of his immense contribution He summed up the ancient lore of knowledge, in science, philosophy and literature, possessed at that time by the Arabs, the Iranians, the Greeks, the Jews, the Indians and other nations including the Egyptians There is much of modern spirit and method of critical study and research in him He is considered to be a phenomenon in the annals of Eastern learning and literature

Some 1,000 years ago he came up with new revolutionary theories in astronomy, mathematics, chronology, physics, medicine, history and geography that continue, in many instances, to hold good even today Among his theories was that the earth rotates on its axis He correctly calculated longitude and latitude And he determined with a spectacular degree of accuracy the specific weights of 18 precious stones and metals

Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī was born in a suburb of Khwārizm (modern Khiva) on Dhū al-Ḥijjah 3, A H 362 (Sept , 4, A D 973) Khiva is now the capital of the Uzbekistan Republic of the U S S R

The first part of al-Bīrūnī's life was spent in Khwārizm, and it was here that he learnt the natural sciences After his studies, he was attached to the court of Prince Ma'mun b Ma'mun in Khwārizm, where he was held in high esteem

on account of his learning. But at this time, unfavourable political changes compelled him to leave his native land and migrate to Jurjan, where he was equally well treated Here he embarked upon a career of writing and in A.D. 1000 completed his celebrated book "*Al-Āthār al-Bāqiah*", the Chronology of Nations This book was dedicated to Qābūs b Washmgīr, the ruler of Jurjān From here, he again repaired to Khwārizm near about A H 400 By this time, he had won his reputation as a great scholar and was appointed, in his native country, a councillor at the court of Prince Ma'mun His extraordinary qualities of head and heart made him eminently competent for the high office in the state that he occupied In Khwārizm he wrote another book *Chronicle of Khwārizm* in which he described the traditions relating to the antiquity of his native country and the events of which he had himself been a witness After a few years' stay here, he went to Ghaznah at the invitation of Sulṭān Maḥmūd in the spring of A H 408 He often accompanied Sulṭān Maḥmūd on expeditions to India Here he learnt Sanskrit and studied religions and sciences of the people of India His book "*Kitāb al-Hind*" in Arabic deals with the religious beliefs of the Hindus and their morals

In A D 1031 Mas'ūd, son of Sulṭān Maḥmūd, succeeded to the throne To Mas'ūd, he dedicated his greatest work, *al-Qānūn al-Mas'ūdī* He received a pension which enabled him to devote the rest of his life to literary works and scientific studies It is said that Mas'ūd sent him an elephant-load of silver coins for writing *al-Qānūn*, but he returned it to the treasury

As a writer, his industry equalled his learning During his 65 years, according to a list that he prepared, he authored over a hundred books The list as included by Sachau in the German Introduction to his edition of *al-Āthār al-Bāqiah* comprises

1	Geometry, astronomy, etc	18	works
2	Geography	15	,,
3	Arithmetic	8	,,
4	Light	4	,,
5	The Astrolabe	5	,,
6	Times and Seasons	5	,,
7	Comets	5	,,
8.	Stations of the Moon	12	,,
9	Astrology	7	,,
10	Persian and other tales	13	,,
11	Religion	6	,,
12	Books of which the author retained no copy	5	,,
13	Unfinished books	10	,,
	Total	113	,,

Al-Bīrūnī was one of the greatest astronomers of Islam. He wrote two books on astronomy "*Kitāb al-Tafhīm fi Ṣinā'ah al-Tanjīm*" (Explanation of the Science of Astronomy) was written in A D 1029 at Ghaznah and was dedicated to Rehanah, daughter of Ḥusayn Khwārizmī Originally it was in Arabic, but the author later translated it into Persian It may be regarded as a primer of 11th century science Apart from discussions on geometry and astronomy and the use of the astrolabe, it treats geography and chronology also

"*Qānūn al-Mas'ūdi*", dedicated to Sulṭān Mas'ūd was his second book This book sums up the knowledge in astronomy and mathematics possessed at that time For centuries it continued to occupy an important position as the standard book of reference in the Eastern seats of learning It has also been recognised in the West

Al-Bīrūnī says, in the first chapter of his "Explanation of the Science of Astronomy" (*Kitāb al-Tafhīm fi Ṣinā'ah al-Tanjīm*) "A man does not merit the title of astronomer until he has attained proficiency in four sciences, viz, first, Geometry, secondly, Arithmetic, thirdly, Cosmography, and fourthly, Judicial Astrology" He was proficient in all these four Niẓāmī 'Urudī Samarqandī in his "*Chahar Maqalah*" (Four Discourses) has narrated an interesting story regarding his proficiency in astronomy He states

"It is related that once when Yamin al-Dawlah Sultān Maḥmūd ibn Naṣīr al-Dīn Subuktigīn was sitting on the roof of a four-doored summer-house in Ghaznah, in the Garden of a Thousand Trees, he turned towards Abū Raiḥān and said, "By which of these four doors shall I go out?" (for all four were practicable) "Decide and write the decision on piece of paper, and put it under my quilt ' Abū Raiḥān called for an astrolabe, took the altitude, determined the ascendant, reflected for a while, and then wrote down his decision on a piece of paper Maḥmūd bade his men bring a navvy with pickaxe and spade, and in the wall which was on the eastern side, they dug out a fifth door, through which he went out Then he bade them bring the paper So they brought it, and on it Abū Raiḥān had written, "He will go out through none of these four doors, but they will dig a fifth door in the eastern wall, by which door he will go forth" Maḥmūd, on reading this, was furious, and bade them cast Abū Raiḥān down in the midst of the palace, and so they did Now there was stretched a net from the middle floor, and on it Abū Raiḥān fell The net snapped, and he subsided gently to the ground, so that he received no injury Maḥmūd again asked him, "O Abū Raiḥān, at all events you did not know about this event" "I knew it, Sir," answered he Said Maḥmūd, "Where is the proof?" So Abū Raiḥān sent for his Almanac and produced the prognostications out of the Almanac, and amongst the predictions of that day was written 'Today they will cast me down from a high place, but I shall reach the earth in safety, and arise sound in body' All this was not

according to Maḥmūd's liking He waxed still angrier, and ordered Abū Raiḥān to be detained in the citadel So Abū Raiḥān was confined in the citadel of Ghaznah, where he remained for six months

It is said that during his six months' incarceration none dared speak to Maḥmūd about Abū Raiḥān Ultimately on the intercession of his Prime Minister, Aḥmad ibn Hasan of Ma'imand, who was for six months seeking an opportunity to say a word on behalf of Abū Raiḥān, he was released and honoured by the King

AL-BĪRŪNĪ'S CONTRIBUTION TO NATURAL SCIENCES

PROFESSOR ABDUR RAUF NOWSHERVI

A comprehensive study of Abū Raiḥān Muḥammad Ibn Aḥmad al-Bīrūnī, undoubtedly one of the most learned Muslim Scholars, is a doubly difficult task, because in those of his works that are easily available, no attempt has been made to deal with this subject thoroughly, and systematically, and on the other hand the original philosophical work which he has attempted and in which he has treated this subject more fully, are either rare or extinct

In order to appreciate his approach to the manifestation of nature, an attempt has been made to assemble small bits from his works, where he gives the reader a glimpse of his views about various aspects of nature

The long life of al-Bīrūnī, which saw so much political turmoil and change in the outward conditions of life in central Asia, Afghanistan and Iran etc, also witnessed considerable change in his interest Attracted early to mathematics and astronomy, in which he became one of the greatest authorities in the annals of Muslim science, his attention later turned towards chronology and history and finally during later part of his life, to optics, medicine, mineralogy and pharmacology

The great bulk of the writings of al-Bīrūnī, which according to Yāqūt[1] were more than a camel load, are mostly in Arabic, and a few in Persian, although his mother tongue was neither of them, but Khwārizmī According to Yāqūt his contribution to astronomy, logic, medicine are numerous, and he states to have witnessed its catalogue in Jamia-Maro spread over 60 pages in the present paper's type One of his earliest biographers, Shams al-Dīn Moḥammad Shahrazūrī writes[2] "that he (al-Bīrūnī) never had a pen out of his hand, nor his eyes ever off a book, and his thoughts were always directed to his studies, with the exceptions of two days in the year, namely Nawroz and Mihrjān, when he was occupied in procuring necessaries of life" Even a few moments before his death he is said to have enquired about a problem in geometry

In addition to personal contact with numerous Muslim, Christian and Hindu scholars and sages of his time, al-Bīrūnī also had access to many ancient works of Greek, Babylonian and Zoroastrian sciences

Al-Bīrūnī did not have smooth sailing all the time While at Maḥmūd's court he was given scanty facility[3] for scientific research, because Aḥmad bin Ḥassan Ma'imandī, who was responsible for Firdausī's exit, was not very friendly with him

In his book on India, al-Bīrūnī complains bitterly of the limitations imposed on his movements and the difficulties encountered by him in his cultural and literary pursuits

George Sarton[4] calls him "one the greatest scientists of Islam and all considered, one of the greatest of all times" He surely was in every way remarkable Encountered with truth, he was interested in everything, history, chronology, geography, medicine, philosophy, mineralogy, mathematics and astronomy But whatever subject he approached he did so with an open mind, a mind trained to scientific accuracy He aimed at genuine scholarship With great pain and care, he would gather all available data, check his methods and apply the rule of logic in his interpretations As he writes himself[5]

> I have truly done what every one is bound to do in respect of any particular science That is to accept gratefully, the original contribution of his predecessors, to correct fearlessly the errors that came to his notice and to preserve what he himself discovered and to leave record for the future generations"

Nothing angered him more than intellectual deceit, or false sciences or hiding the truth for the sake of popularity

In view of his convictions, al-Bīrūnī exemplified[6] all the essential qualities of a great scientist in the broadest sense, notably

1 His burning curiosity, which was disciplined and sustained

2 A love for truth that was sovereign in all his thinking

3 A healthy scepticism, ready always to test all assertions

4 A resolute effort at objectivity and refusal to be beguiled by plausibility or romantic charm, unless supported by proof Like a true scientist al-Bīrūnī, therefore, insists on the necessity of observation and experiment and is scornful of those who uncritically merely repeat traditions For example he studied Aristotle's views on physics and heavens, and often differed with him Not only that but he discussed these points with Ibn Sīnā, who was pro-Aristotle in his views He put to him a number of questions and when he found Ibn Sīnā's answer not very satisfactory, he made a counter statement to answer them

Like a modern scientist he is scornful of pseudo-sciences and is contemptuous of those, who in their greed for gold, spend a lot of effort on the kind of alchemy from which they hoped to acquire limitless riches Alchemy, according to him is a make-believe science motivated simply by excessive eagerness for acquiring fortune, although in principle[7] he accepts cosmological principles of alchemy and the Jābirian theory for the formation of metals, while rejecting the possibility of transmutation because of the lack of evidence, and supports Ibn Sīnā when he says, "There is no way of splitting up one combination into another" About ālchemy he further adds, "No nation is entirely free from it, and many intelligent people are entirely given to alchemy " It was 700 years after these shrewd remarks before Europe gave up its pursuit of alchemy

Now turning to Natural Sciences, we discover that al-Bīrūnī was a master of observation, not only in astronomy, geology, mineralogy and geography, but also in the study of natural phenomena His description of flora and fauna shows him as a master observer of the multiple forms of nature He showed himself to be the true picture of the Qur'ānic injunction

و يتفكرون فى حلق ا لسموا ت و الا رض - ربنا ما خلقت هدا باطلا (3/189)

> "And contemplate the (wonders of) creation in the heavens and the earth (with the thought) our Lord, not for naught hast Thou created all this"

His geological observations[8] mentioned in passing in several of his work, such as *al-athār al-Bāqiah* and *Tahdīd Nihāyah al-Amākin*, are astounding for their exactitude and depth and include the correct judgement about the sedimentary nature of the Indian Basin On the experimental side, he worked out the sp gravities of 18 precious stones and metals, that are remarkably accurate He knew that the speed of light is immensely greater than that of the sound He also explained on the hydrostatic principles, the ascent of water in natural springs and artesian wells As a keen observer of natural phenomena, he marked carefully the succession of changes in the light of the sky at dawn and dusk and was the first accurate observer and describer of Zodiacal Light He also tried to explain why the sea water becomes saltish and bitter For his interest in zoology we may quote his description of abnormality[9] of child birth, including the Siamese Twins It is interesting to note that al-Bīrūnī mentions specifically the monkey as the last animal through whom man has migrated to reach his present state Some have agreed, this passage announces the modern theory of evolution, 800 years before Darwin, while others believe that he said this as an instance of the function of nature as the "preserver of species"

Al-Bīrūnī has a feeling for harmony and for the role of geometry in nature For example about flowers[10] he observes, "Among the peculiarities

of flowers there is one really astonishing fact *viz* the number of their leaves, the tops of which form a circle, when they begin to open, is in most cases, conformable to the law of geometry Generally they agree with the chords formed by the laws of (plane) geometry, not with conic section You scarcely ever find a flower of 7 or 9 leaves, for you cannot construct them according to the laws of geometry in circle or isosceles triangle The number of their leaves is always 3, or 4, or 5, or 6 or even 18 This is a matter of frequent occurrence possibility one may find, among the species, hitherto known with such a number of leaves, but on the whole one must say, nature preserved its genera and species such as they are If you could for example count the number of seeds of one of the many pomegranates of a tree, you would find that all the other pomegranates contain the same number of seeds, as that of the one whose seeds you have counted first So, too, nature proceeds in all other matter

Another instance of the use of measurement by al-Bīrūnī is in his well known determination of density of minerals described in his book, *Kitab al Jawāhir*[11] where he applies hydrostatic principles He weighed the body first in air, then in a conical vessel in water, water thus thrown through a hole or a spout was its volume He thus calculated the sp gravity

This method of finding the sp gravity is attributed to Archimedes, but the credit for the accuracy of result up to second place of decimals undoubtedly goes to al-Bīrūnī

Values found out by him are reproduced below —

	al-Bīrūnī's values	*Correct values*
Gold	19 05 — 19 26	19 29
Copper	8 72 — 8 83	8 85
Mercury	12 74 — 13 59	13 56
Brass	8 55 — 8 67	8 40

In this way he gives the sp gravity of 9 metals, based on the weight of gold and for 9 gems based on the weight of "Oriental Sapphire" These values as given above differ only slightly from modern measurement

These examples demonstrate, al-Bīrūnī's role as a careful observer and experimenter He has often been admired by modern scholars for this aspect of his research, because it is this particular approach to nature, which has been so actively pursued since 17th century

To conclude, I would like to state that despite a great deal of research carried out by scholars of many countries on the writings of al-Bīrūnī, much remains to be done, considering the extent of his writing and the numerous disciplines, with which they are concerned His books are to be traced, translated and published, so that the common man may know the breadth and depth of his writings

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10	*Ibid*		p 127
11	*Ibid*		pp 130-131

'KITĀB AL-JAMĀHIR FI MA'RIFAH AL-JAWĀHIR' : Al-Bīrūnī's Contribution to Biological Studies And Concepts

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ABŪ Raiḥān Muḥammad Ibn Aḥmad al-Bīrūnī is more well known for his studies of geography, pharmacy, physics, cosmology and astronomy His book '*Kitāb al-Jamāhir*' has been regarded as an outstanding contribution in the field of geology in relation to precious stones Indeed in all these fields he has made a contribution of highest value and significance His approach marks the establishment of true and correct or even modern scientific method He collects, scrutinises and evaluates almost all known information precisely quoted from authors previous to him from Greek to contemporary

Further more he verifies the known facts by his personal incisive observations His interpretations are based on objective, critical and integrated thinking Thus he stands out as a modern scientist one thousand years ago

Al-Bīrūnī combines in himself a scientist of widest interest and comprehensive knowledge He was not so well known as biological scientist This was an injustice to him Probably Hossein Nasr (1964) in his book "*An Introduction to Islamic Cosmological Doctrines*" referred for the first time in recent years to his understanding of organic evolution in the English language This has initiated interest in further studies of al-Bīrūnī's contribution to biological sciences

A detailed study of al-Bīrūnī's observations in his various books will be highly rewarding for a modern biologist

The *Kitāb al-Jamāhir* is not simply a scientific, descriptive and a literary book on pearls and precious stones It is far more than this It covers a range of subjects from geology to cosmology, including biology, human psychology, sociology and medicine

The book includes a series of fifteen introductory chapters ترويحه which may be translated as "Amusing Breezes" or "Invigorating Aerations" These include fundamental knowledge of man The first chapter deals with the important aspects of plant and animal life, in regard to their physiology His brief remarks on plant physiology mention the transport of food material from soil through fine capillaries He also says that plants liquefy food material and store them Of much greater significance are his remarks about transpiration (Chapter 1, Page 3, Line 6) These clearly confirm his understanding of the role of sun and atmosphere and the green shoots in the evapo-transpiration in plants.

ترفع سخونة الجو بالشمس من اغصانه رطوباته

In the first "*Tarwihah*" al-Bīrūnī deals with the physiology of human senses For the perception of light he indicates the correct role of light travelling in the air and different colours, shape, form and number of the objects In case of the senses of smell and taste he identifies receptors, the media of the stimuli and the mode of their conduction through vapours or liquids

He clarifies important details of sensoria of touch by saying that they are located all over the body specially in skin form where the stimulus penetrates through various layers till it reaches the viscous and complex areas inside the body

Insofar as organic evolution is concerned his views were reported by Nasr (1964) and Qadri (1970) His brief remark is quoted below

انه صعد الى الانسانية من انواعها حتى ارتقى من الكلبيه الى الدبيه" ثم القرديه"
الى ان يادمن

This sentence asserts al-Bīrūnī's view that mankind travelled high through species till it evolved through cats (felidae) on to the bears (ursidae) on to primates (apes) till it reached the anthropoid stage or rank

These views were subsequently repeated by Shams al-Din al-Damashqi in his book '*Nukhbat al-Dahr*', 1256 A D and also by Ibn Khaldun مقدمه تاريخ ابن خلدون long after al-Bīrūnī

Confining my studies of al-Bīrūnī s references to animals I first deal with sponges (Page 191, line 12)

انه يشابه الحيوان بما يحكى عنه و هو على حجره ينقبض من اللمس

He clearly holds that sponges are animals because they contract on touch Thus he established animal life at a very low level of animal organisation The next group of animals with which he has dealt are corals named as مرجان '*Marjan*' and '*Bussad*' البسد The corals have been regarded as minerals or

plants or combining the properties of the two Starting from Aristotle to al-Kindi and even subsequent to al-Bīrūnī the scientist regarded corals as minerals in their 'bodies' and plants in their 'souls' Al-Bīrūnī criticised this view after observation

He examined the edges and 'parts' اطرا و قطعا of corals, which were not calcified and noted that these harden after softness (P 191, line 8)

لا محالة انها صلبت بعد لينها كتحجر السراطين البحرية عند اخراجها من الماء

Thus he hints that the first coral is a soft individual This observation is of utmost biological importance and ranks highest till 17th century

Going much farther than that he credited the corals with possession of organs of sense of touch, perception and contractions which he regarded as animal properties This marks the greatest advancement in field of zoology till Cuvier or Lamark Even in the 17th century the corals were regarded as plants

Al-Bīrūnī has made a very incisive and comprehensive study of the structure, development and classification of corals He has correctly distinguished betweeen Alcyonarian and Zoantherian corals

His studies of Zoantheric corals are far advanced and remain unsurpassed till the 18th or 19th century A D (pg 192) He has noted septa or mesentries in the finger-like-bodies of the Madreporic corals He has distinguished the internal circular gullet or cavity and even marked out the directive septa or mesentries known as siphonoglyphes which are shortest and run into gullet

Dealing with a number of varieties of corals from different seas he hints on a coral from the Gulf of Aden which he says has a twig like body dragged from the sea bottom in a manner like that of an oyster This twig weighs a pound in weight This may be another coral called Seapen belonging to order Pennatulacea

Al-Bīrūnī has excelled far beyond others in his studies of pearls, pearl formation and of shells including bivalves shell and the univalve gastropod molluscs His studies of the structure and growth of oysters are absolutely original Describing the oysters structure as mentioned in appendix of the book (Hyderabad Edition page 4) he says that oysters have two valves attached to the body by a hinge The valves open and close with the intention of the animal with which they are attached He has referred to foot and palial membrane and the body He regards the foot as the ear lobes He tells that this animal is fluidy, viscous and possesses meat

Describing the development of oyster he refers that it starts as a leaf of asofoetida كور له ا نعد ان then it falls, attaches itself, hardens its shells and grows In dealing with oysters he has referred to edible oysters which he says are as delicious as egg and are eaten as food

Describing a large variety, of oyster al-Bīrūnī has included other molluscan shell belonging to class Gasteropoda viz spirals, periwinkles, cockles, cowries, chunks and conches He has mentioned about الودع cowries of various shapes, colours and size He referred to cowries as substitutes of coins He has also referred to ornamental uses of shells He has made a direct and correct reference to Indian chunks and shells used for amplifying and blowing of sounds

Al-Bīrūnī has also referred to the gregarious habits of the oysters and has noticed the formation for the oyster "spat" (P 4 of the appendix line 13) in details

Al-Bīrūnī has observed and studied pearl formation more thoroughly and deeply than anyone preceding him The current view held from Greek to his age was that the pearl had its origin from a drop of rain water He however says "The pearls grow from the body of the oyster and not from the drop in the manner of deposition of layers or scales" He further says (page 5 last line No 23) that pearl which grows layer after layer and that which is not located inside the black flesh adjacent to valves is free from defect He has almost asserted that through secretion the layers are deposited round اول الملعمه- لبنا رطبا the first soft fluidy amalgam Then it is impressed upon by gravel round which secretions are deposited This is the most modern view of pearl formation According to him the secreted layers can be compared with the scales of onion which form into one single whole (page 6 lines 4 to 9) Al-Bīrūnī has categorically discarded the prevalent and common theory that the pearl is located in the flesh and it grows with the time Instead he insists on growth of pearl from deposition of layers

He has referred to pearl fisheries from Persian Gulf to Mekran coast, in the Gulf of Aden, in the Red Sea, around Ceylon as well as along East African Sea Coast and Islands of Socotra and even in Chinese Waters

The author confesses that his studies are limited to narrow range of subjects even in the field of zoology which could be further derived from Al-Bīrūnī's writings He could not go beyond *Kitāb al-Jamahir* which makes a difficult reading of Arabic Mr Mohammad Saud, Fellow of Islamic Research Institute at Islamabad has helped him a lot in the interpretation and translation of Arabic terminology

The author has confined himself to al-Bīrūnī's studies of important facts about plant transpiration, man, sponges, corals and oysters. Al-Bīrūnī has also referred to seas, waves, tides and diving The latter topic is dealt with in great detail He mentions the months, seasons and times of diving He has also referred to spots free of sharks and harmful animals He has mentioned the evil fish shark with long tail with which it hits and is known as the حمل البحر Camel of Sea or the Sea Carnivore كوسج the crocodiles (pp 143, 144).

QUOTATIONS FROM KITAB al-JAMAHIR

Page 3 **Physiology of Plant**

(i) Transport of food material
(ii) Liquefication of solid through vessel
(iii) Storage of food
(iv) Transpiration with the help of sun and the atmosphere.

Page 4 **Sense of Vision**—Perception of light

Travel of light in the air
Distinction of special colour with the help of light and perception of shape, form and number

Sense of hearing—Sensory organs appreciates sounds borne in the air

Sense of smell:

Fragrance and air connects these with the content with their receptors, these separate smell vapour from water vapour contained in the air

Sense of taste

Perceived through food and moisture which they contain and connect with taste receptors and bring them in the spaces in organs located in tongue and back of the palate

These four senses are dispersed in variour parts of the body

Sense of touch.

Spread over all parts and organs of body-First received on the external surface of the body perceived on the skin, then deepens, further and further in the soft and sensitive layer till it reaches the complex and viscous areas of the depths of the body

Page 80 **Evolution of Man .**
Line 17

He attained the height of stature with the additions from animal. Humanity evolved through species evolving from (Felidae) الكلبيه to (Ursidae) الدبيه then on to (Primates) قرديه and then to anthropoid stage

Page 191 **Corals**
Line 7

I have seen edges (Diameter) and pieces (Sections) which are not calcified in the same way as crab calcify after emerging from sea Certainly these pieces harden after softness

Page 191 Corals, the author of ***Kitāb al-Sarya*** says, resemble mineral in body and plants in the soul, oysters and sponges resemble mineral in the soul and plant in the bodies

I say about the sponge it resembles animals and it contracts on touching it The oyster does not belong to this category They move from rest, are sensitive and take food They resemble the mineral by their shells Similar shells are in mollusc, in animal turtle, plates of crocodiles These shells are different from the minerals where the animal is located Sense of touch or perception are weak and therefore septas are grown to support and strengthen

Oysters structure page 4 of appendix, oysters have two valves attached to the body by a hinge They open and close at the intention of the animal with which it is attached

These animals make creeping and crawling movements on the earth The oyster's organs of support are weak and the animal is adhesive and secretive

Oyster spat Oysters arranged in connected row They collect and pile up, arrange their hands, mouths and bodies along the same direction

Page 5 **Birth of Oyster**—Like pages of paper they fall on stone and are hardened

Page 5 **Birth of Pearl**—Pearls originate from the body of oyster and not from drops as said and conceived

APPENDIX

MODERN HISTORY OF PHOTOSYNTHESIS AND TRANSPIRATION

After Stephen Hales's (1677-1761) great initiative of vegetable physiology and Priestley's (1733-1804) discovery of oxygen, and the hardly less important steps taken by Ingenhousz (1730-99) and De Saussure (1767-1845) there began to be some understanding of photosynthesis, the most important vital process of the world in which green plants using the energy of red orange rays break up carbon dioxide liberating oxygen and building up carbon compound such as sugar

Sir Arthur Thompson and Geddes pg 1443 (*Life Outline of General Biology*, London 1931)

> "Van Helmont (1577-1644) concluded that plants draw their whole substance from water (He did not of course know the part played by the atmosphere especially carbon dioxide in growth of plant)

Charles Singer—*A Short History of Scientific Ideas to* 1900 *A D*—Oxford 1959

> "An interesting contribution of Stephen Hales (in his Vegetable Staticks, 1727) "was his demonstration that air supplies something material to the substance of plant "

> "Thus measuring the amount of water taken in the roots and that given off by the leaves re-established what Botanists now call transpiration (Charles Singer, pg 404)

> "Very important was Liebig's (1802-73) teaching that plants derive the constituent of their substance, their carbon and nitrogen from the carbon dioxide and ammonia in the atmosphere "

> (Charles Singer, pg 408)

AL-BĪRŪNĪ'S METHODOLOGY AND ITS SOURCES

OBAIDULLAH QUDSI

ABŪ Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī was born in Khwārizm in 973 He died in 1048 A D at Ghaznah in Sijistān [1]

Professor F Krenkow writes, "Though I am not quite as enthusiastic as Professor Sachau is stated to have been in calling him the greatest intellect that ever lived on this earth, I will readily admit with others, that he was a most remarkable man and in advance of his time [2]

This remarkable man in starting his treatise writes

و الله اسئل ان يوفق للصواب و يعين على درک الحق و يسهل سبيله و ينير طريقه و يرفع الموانع عن نيل المطلوب المحمود -

كتاب التحديد — ص ۵۴

"And I pray for God's favour and spacious bounty to make me fit for adopting the right course and help me in perceiving and realising the Truth, and facilitate its pursuit and enlighten its Courses (methods) and remove all impediments in achieving noble objects "

فانی لا آبی قبول الحق من ای معدن وجدته

كتاب التحديد — ص ۱۰۴

"I do not scorn to accept truth from whatever source I can find it ' [3]

He prayed for Divine guidance and followed it while formulating his methodology When we study his methods we discover the impact of the *Holy Qurā'n* on him and the inspiration that he received from it

The birth of Islam, as Iqbal presents in his "Reconstruction of Religious Thought in Islam", is the birth of the inductive intellect In Islam prophecy reaches its perfection, hence the need for its abolition. This involves the keen

perception that life cannot for ever be kept on leading strings; that in order to achieve full self-consciousness man must finally be thrown back on his own resources "The abolition of priesthood and hereditary kingship in Islam, the constant appeal to reason and experience in the Qurān', and the emphasis that it lays on Nature and History as sources of human knowledge, are all different aspects of the same idea of finality" [4]

"The intellectual value of the idea is that it tends to create an independent critical attitude towards mystic experience by generating the belief that all personal authority claiming a supernatural origin, has come to an end in the history of man Mystic experience, then however unusual and abnormal, must now be regarded by a Muslim as a perfectly natural experience, open to critical scrutiny like other aspects of human experience [5]

"That the Law (of Islam) summons to reflection on beings and the pursuit of knowledge about them by the intellect is clear from several verses of the Book of God, Blessed and Exalted, such as the saying of the Exalted, "Reflect, you have vision", فاعتبروا يا اولى الابصار This is the textual authority for the obligation to use intellectual reasoning or a combination of intellectual and legal reasoning Another example is His saying, "Have they not studied the kingdom of the heavens and the earth, and whatever things God has created?" This is a text urging the study of the totality of beings

"Since it has now been established that the Law has rendered obligatory the study of beings by the intellect, and reflection on them and since reflection is nothing more than inference and drawing out of the unknown from the known, and since this is reasoning or at any rate done by reasoning, therefore we are under an obligation to carry on our study of beings by intellectual reasoning It is further evident that this manner of study, to which the Law summons and urges, is the most perfect kind of study using the most perfect kind of reasoning, and this is the kind called demonstration " [6]

According to the Qur'ān, Nature and History are sources of knowledge, and it is in tapping these sources of knowledge that the spirit of Islam is seen at its best [7] The Qur'ān sees the lengthening out of shadows, the alternation of day and night, the variety of human colour and tongues, [8] the alternation of the days of success and reverse among people, in fact in the whole of nature as revealed to the sense-perception or signs and asks us not to bypass them 'as if he is deaf in this life and hence will remain blind to the realities of the life to come ' [9]

This appeal eventually brought Muslim thinkers into conflict with Greek thought which, in the beginning of their intellectual career, they had studied with so much enthusiasm

This intellectual revolt against Greek philosophy manifests itself in all departments of thought It discloses itself in mathematics, astronomy, and medicine

"Ibn Hazm, in his scope of logic, emphasizes sense-perception as a source of knowledge, and Ibn Taymiyyah, in his Refutation of Logic, shows that induction is the only form of reliable argument Thus arose the method of observation and experiment" [10]

Al-Birūni used the scientific method perfectly in the sciences and wrote immensely on astronomical and mathematical topics such as Indian arithmetic, extraction of cube-root, ratio and proportion, calculation of heights and distances, direction of the *qiblah*, balance and its calculation of chords and tangents, construction of astrolabe and its use, time and its conception, days and nights, the moon and its phases, twilight, eclipses, comets and meteorites, horoscopes, Indian astrology, measurement of the earth by observing the dip of the horizon,[11] methods of projection of bodies and spheres on planes, which he claims[12] to have been put for the first time before the world [13] Europe has been rather slow to recognize the Islamic origin of her *scientific method* But full recognition of the fact has at last come Let me quote a few lines from Briffault's "*Making of Humanity*" [14]

"It was under their successors at the Oxford School that Roger Bacon learned Arabic and Arabic Science Neither Roger Bacon nor his later namesake has any title to be credited with having introduced the experimental method Roger Bacon was no more than one of the apostles of Muslim science and method to Christian Europe, and he never wearied of declaring that knowledge of Arabic and Arabic Science was for his contemporaries the only way to true knowledge Discussions as to who was the originator of the experimental method are part of the colossal misrepresentation of the origin of European civilization The experimental method of Arabs was by Bacon's time widespread and eagerly cultivated throughout Europe " (p 202)

Science is the most momentous contribution of Arab civilization to the modern world, but its fruits were slow in ripening

The ancient world was, as we saw, pre-scientific, the minute methods of science, detailed and prolonged observation and experimental inquiry were altogether alien to Greek temperament

What we call science arose in Europe as a result of a new spirit of inquiry, new methods of investigation, new methods of experiment, observation, measurement, of the development of mathematics in a form unknown to the Greeks That spirit and those methods were introduced into European world by the Arabs (p 190)

According to the Qur'ān knowledge must begin with the concrete It is the intellectual capture of, and *power* over, the concrete that makes it possible for the intellect of man to pass beyond the concrete The Qur'ān says

'O company of djin and men, if you can overpass the bounds of the Heavens and the Earth, then overpass them But by power alone shall ye overpass them (55 33)

The finite, as such, is an idol obstructing the movement of the mind, or in order to overpass its bounds the mind must overcome serial time and the pure vacuity of perceptual space In a culture with such an attitude, the problem of space and time becomes a question of life and death

The Ash'arite, were, therefore, driven to develop a different kind of atomism, and tried to overcome the difficulties of perceptual space in a manner similar to modern atomism [15] On the side of mathematics it must be remembered that since the time of Ptolemy (A D 87-163) till the time of al-Bīrūnī (973-1084 A D) nobody gave serious thought to the difficulties of demonstrating the certitude of Euclid's parallel postulate on the basis of perceptual space It was al-Bīrūnī who first disturbed the calm which had prevailed in the world of mathematics for a thousand years

It is al-Bīrūnī who for the first time approached trigonometry as an independent subject He developed the subject in a systematic way and has the credit of, for the first time, keeping it independent of astronomical calculations [16] Al-Bīrūnī's method and his formulae were universally adopted by later astronomers as is evident from the fact that Ulugh Beg, three centuries later used almost word by word the formulae and phraseology of al-Bīrūnī [17] Dr Ziauddin Ahmad writes in his book that it is perhaps the only instance in classical literature as well as in the literature of the Middle Ages where a theorem is formulated in the language of the theory of function [18] Further he writes "The formulae that he uses are the same as one finds in any advanced text book on astronomy [19] He was the first to observe and solemnly assert that the assumption that 'the Earth moves round the Sun' could not be disproved, and the explanation of which was later given by Copernicus in his theory [20]

History or, in the language of the Qur'ān, the days of God (ايام الله) is a source of human knowledge It is one of the most essential teaching of the Qur'ān that nations are collectively judged and suffer for their misdeeds here and now [21] Scientific knowledge about the consequences of man's act may be of the greatest importance for a moral judgement of its rightness [22] In order to establish this proposition he urges upon the reader to reflect on the past and present experience of mankind [23]

"Of old did we send Moses our signs, and said to him 'Bring forth thy people from the darkness verily, in this are signs for every patient, grateful person '" [24]

"And among those whom we had created are a people who guide others with truth, and in accordance therewith act justly But as for those who treat our signs as lies, we gradually bring them down by means of which they know not and though I lengthen their days, verily, my stratagem is effectual"[25]

"Already, before your time, have precedents been made Traverse the Earth then, and see what hath been the end of those who falsify the signs of God "[26]

The Qur'ān suggests a scientific treatment of the life of human societies and has a historical doctrine[27] The Muslim historian in the light of this doctrine became the pioneer of the modern technics

Al-Bīrūnī's *India* has been mainly due to the inspiration which the author must have received from the Qur'ān An instance in point is his paragraph devoted to an estimate of the character of the Arabs as a people

"As regards unnatural kinds of marriage, we must state that such exist still in our time (in India), as they also existed in the times of Arab heathendom '[28]

"The Arabs of the desert are most stout in unbelief and dissimulation, and likelier it is that they should be unaware of the laws which God hath sent down to His Apostle, and God is Knowing, Wise "

Al-Bīrūnī clearly mentioned his point of view after comparing some institutions

"We have given here an account of these things in order that the reader may learn by the comparative treatment of the subject how much superior the institutions of Islam are, and how much more plainly this contrast brings out all customs and usages, differing from those of Islam, in essential foulness '[29]

His methodology is nearer to those presented by Muslim jurists in Islamic Law (*Fiqah*) and reporters (*Muhaddithīn*) in tradition It is fully infused with Divine light and is grounded in the Qur'ān which with its emphasis upon truth (*Al-Ḥaq*) appears as the directive and driving force throughout his works He quotes from the Qur'ān in the preface[30] "speak the truth, even if it were against yourselves"[31] Thus truth is the vital, living assimilative force which permeates the entire process of development of his methodology, the scientific method

Al-Bīrūnī explained all the essential qualities of a great scientist in the broadest sense He said that such a scientist must have a burning curiosity which

at the same time must be disciplined and sustained and a love of truth that was sovereign in all his thinking He says

"We ask God to give us a proper insight into the nature of that which is false and idle so that we may sift it so as to distinguish the chaff from the wheat "[32]

The sole concern of al-Bīrūnī in "*India*" was to reconstruct a true record of the life of mankind without fear or favour "This is not a polemical one I shall not produce the arguments of our antagonists in order to refute such of them as I believe to be in the wrong My book is nothing but a simple historic record of facts I shall place before the readers the theories of the Hindus exactly as they are "

"I shall mention in connection with them similar theories of Greeks in order to show the relationship existing between them For the Greek philosophers, although aiming at truth in the abstract, never in all questions of popular bearing rise much above the customary exoteric expression and tenets both of their religion and law "[33]

It shows that he was free from the axiomatic dogmatism whether theological or anti-traditional, of the past centuries His method was to signify the effort of the mind to see things as they are, to appraise literature at its true worth, to judge the records of Hindu thoughts, deeds and customs impartially, without the prejudices of personal likes or dislikes Al-Bīrūnī used most effectively the comparative method in the history of human knowledge We find him explaining and systemising this method He tells us in the preface that he was led to write down his observations on the religious customs and beliefs of the Hindus at the insistence of Abū Sahl of Ṭiflis, because he discovered that most of the available literature on the subject of the non-Muslim religions sadly misrepresented those religions, both because of inadequate acquaintance with source material, and because of a highly prejudiced attitude towards the religions they were describing He thinks that it is possible to give an adequate account of their religions and a fair and an unbiased description of their beliefs and practices if one follows the right methods Both in his *India* and in his *Chronology*, he has a good deal to say about methods to be used in such investigations

He made comparative studies of institutions in Indian history with very great accuracy of detail and precision in analysis He shows the possibility of a variety in interpretations if one adopts impartiality in judgement

On the stations of the moon he says, "The Arabs determine their lunar stations as beginning with the moon's first becoming visible in the west till her ceasing to be in the east "

However, the Arabs are illiterate people, who can neither write nor reckon They only rely upon numbers and eyesight They rely on no other medium of research than their eyesight, and are not able to determine the lunar station without the fixed stars in them [34]

In the same manner after a detailed study of the Hindu explanation of the lunar station, he says "The Hindus are very little informed regarding the fixed stars" [35] He says "The notion of the Hindus regarding the stars are not free from confusion They are only little skilled in practical observation and calculation, and have no understanding of the notion of the fixed stars" [63]

I have taken the greatest pains to investigate this subject, and to settle most of it by all sorts of comparisons, have recorded the result of my research in a treatise, "*On the Determination of the Lunar Stations*" [37]

He used the comparative method in the following manner First he collected written traditions and enquired from the people themselves, then he compared the traditions and opinions of one group regarding a certain institution with the traditions and opinions of other groups, then he compared Greek thought with Hindu thought and then he reached some conclusion

He very carefully points out all difficulties and problems that crop up when one applies the method Comparison can be of little use unless the material on both sides of comparison is set forth not only completely but also accurately Thus he himself, in the matters of months, though he had gathered information about the Tibetans, Chinese, Negroes, and Ethiopians, he thought it best to postpone writing on them till his information was more complete, for otherwise, he says, he would be going contrary to his method of refusing to mix up the doubtful and the unknown with the certain and the known [38]

Then there is the difficulty that the sources themselves often lack in scientific precision in their descriptions of their own religious beliefs and customs [39] For this reason he insists that the writer of a comparative study must himself take great care about the wording of every sentence he writes, lest due to some misunderstanding of his words wrong conclusions be drawn from his comparisons

There is ever present the difficulty of textual corruption Not all scribes are careful and some are almost unbelievably careless Therefore he insists that an aspect of methodology is the examination of witnesses to ascertain what value their evidence has As he is familiar with the law and evidence of Islam in which criticism of evidence and examination of the witnesses is very important, he asserted that evidences could never be accepted without critical examination He examined and found that some authors were merely copying from others [40] and sometimes by comparing the statements of writers he found

that on important points they have all gone astray through a misunderstanding of source from which they have all drawn [41]

He examines and checks his sources of reference in a scientific manner "Since however, here we have to explain the system and the theories of the Hindus on the subject, we shall now mention their ludicrous view, but we declare at once that they are held only by the common uneducated people For those who march on the path to liberation, or those who study philosophy and theology, and who desire abstract truth which they call *Sara* are entirely free from worshipping anything but God alone [42] "

Some writers are satisfied with some superficial information,[43] other reporters are full of animosities and antipathies, based it may be on national pride or personal predilections[44] and thus they are unreliable because they are biased There are still others who falsify evidence not out of any feeling of animosity, but because of an innate delight in altering and embellishing all that comes into their hands [45] Some of course, falsify simply through ignorance

He thinks that the examination of the witnesses will remove some sources of distortion, but a further check may be imposed by the confrontation of report This will often reveal that certain accounts, otherwise not under suspicion, are not free from confusions and mistakes [46]

Al-Bīrūnī complains against his predecessors that in their work he frequently came upon masses of material unsifted by scientific examination [47]

If we thoroughly examine the above method of al-Bīrūnī we would find that he has followed the rules laid down by the "Muslim Scholars of second and third century (Hijrah) for accepting the traditions and reports by successors of the Prophet (peace be upon him) and successors of the successors and so on

"The critical investigation of the chain has caused the Muslim scholars to make thorough researches They endeavoured not only to ascertain the names and circumstances of the authorities in order to investigate when and where they lived, and which of them had been personally acquainted with the other, but also to test their reliability This criticism of the authorities was called (*Al-jarh wa al-ta'-dil*) (الجرح و ا لتعد يل wounding and authentication)

The so called "knowledge of the men" معرفه الرجال was considered indispensable for every student of Ḥadith The traditions were not all considered of equal value by Muslim scholars, but divided into categories distinguished according to the reliability of their transmitters etc [48]

This law became a permanent subject, ever developing and progressing scientifically Its duty is to ascertain truth, and legitimate use of analogy and its results

Al-Bīrūnī throughout his methods puts emphasis on the character of reporters It is fully evident when he gives us the criteria for judging the validity of tradition He points out how reporters were influenced by the divergency of interest. He says. "The tradition regarding an event which in itself does not contradict either logical or physical laws will invariably depend for its character as true or false upon the character of the reporters who are influenced by the divergency of interests and all kinds of animosities and antipathies between the various nations We must distinguish different classes of reporters"[49]

At present it must sadly be confessed that the prolegomena for such an enquiry is yet to be written[50]

With his own statement we may then close this discussion

"And I have truly done what every one is bound to do in respect of any particular science, that is, to accept gratefully the original contributions of his predecessors, to correct fearlessly the errors that come to his notice and to preserve what he himself discovers and to leave it as a record for the future generation that are to follow him in time[51]

و انما فعلت ما هو واجب على كل انسان ان يعمله
في صناعته من تقبل اجتهاد من تقدمه بالمنة
و تصحيح خلل ان عثر عليه بلا حشمة
و تخليد ما يلوح له
فيها تذكرة لمن تأخر عنه بالزمان و اتى بعده.

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A NEWLY DISCOVERED BOOK OF AL-BĪRŪNĪ "GHURRAT-UZ-ZĪJĀT" AND AL-BĪRŪNĪ'S MEASUREMENTS OF EARTH'S DIMENSIONS

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AL-BĪRŪNĪ'S "GHURRAT-UZ-ZĪJĀT"

1 INTRODUCTORY NOTE

The Arabic Manuscript of al-Bīrūnī's *Ghurrat-uz-Zījāt* was discovered by me in the year 1959 A D and I had obtained its photo-copy from India with great difficulties, its clue was found out by me in the year 1953 A D from Dr Muḥammad Nāzim's famous book named *Life and Times of Mahmūd of Ghaznah* published in the year 1931 A D by Cambridge University Press, on pages 55 and 239 This book pertains to Indian Astronomy and is based on a Sanskrit book named *Karana Tilaka* written by Vijaya Nandi son of Jaya Nandi of Varanasi (India), the original Sanskrit book is now lost and is not traceable anywhere in the world as confirmed by the famous Indian scholar Shankara Balakrishna Dixit in his book on History of Indian Astronomy This unique and unknown book of al-Bīrūnī, along with an English translation and a comprehensive commentary, was first published by me in the Quarterly Islamic Culture of Hyderabad Deccan (India) in eight instalments beginning from April 1963 The original manuscript of *Ghurrat-uz-Zījāt*, consisting of 67 pages and one title page, is kept in the library of Dargah of Pir Muḥammad Shah at Ahmadabad (India), and according to my information it is the only Manuscript in existence in the whole world Photocopies of the title page and the first two pages are given in this Paper

Ghurrat-uz-Zījāt is a sort of astronomical handbook for calculating the planetary positions at a particular time, especially for the preparation of horoscopes etc, other useful subjects have also been included in the text as will be seen from the contents of this book It is a very important book in many respects, especially it is a missing link between *Karana Khandakhadyaka* of

Brahmagupta and *Karana Kutuhala* of Bhaskaracharya It can fill a vast gap in the history of Indian astronomy Most probably the Sanskrit manuscript of *Karana Tilaka*, on which al-Bīrūnī has based his *Ghurrat-uz-Zījāt*, was obtained by al-Bīrūnī at Multān from the local astronomer Durlabha whose name has been mentioned by him in his *Kitāb al-Hind* while describing his stay at that city (vide Alberuni's India 1910, Vol II, pages 9, 10, 54)

Al-Bīrūnī has based his solved examples on the latitude and longitude of Multān which shows that *Ghurrat-uz-Zījāt* was written by him at Multān where he had stayed for a considerable period He has also added much information from his own side in the beginning of this book about various calendars and their inter-relations, in order to make this book useful for all countries of the world This book contains brief accounts of nearly all those subjects which have been dealt with by al-Bīrūnī in his *Qānūn al-Mas'ūdī* in detail, so it will be more appropriate if we say that *Ghurrat-uz-Zījāt* is a miniature *Qānūn al-Mas'ūdī* In other words, after understanding the contents of *Ghurrat-uz-Zījāt* thoroughly, it will be very easy for the scholars to understand the contents of *Qānūn al-Mas'ūdī*

2 ARRANGEMENT OF THE TEXT

Al-Bīrūnī has mentioned the name of *Ghurrat-uz-Zījāt* or *Ghurrat-ul-Azyāj* as a source of various quotations given by him in many of his books such as *Kitāb al-Hind, Qānūn al-Mas'ūdī, Tamhid al-Mustaqar*, and *Afrad al-Miq'āl* etc, but nowhere he has mentioned its name as a complete book written by himself It shows that at that time this book was in the form of his un-checked "First Draft", that is why it was in the shape of independent items which were not arranged under suitable chapters But now I have arranged all these items in the following fourteen chapters without disturbing the serial order of these items, the captions of these chapters have also been given by me on the basis of similar books of this kind

Chapters of Ghurrat-uz-Zijat

Chapter I	Relating to Ahargana
Chapter II	Relating to the Sun and the Moon
Chapter III	Relating to Panchanga
Chapter IV	Relating to the Mean places of the Planets
Chapter V	Relating to the True places of the Planets
Chapter VI	Relating to the Three Problems of Diurnal Motion
Chapter VII	Relating to the Lunar Eclipse
Chapter VIII	Relating to the Solar Eclipse
Chapter IX	Relating to the Shapes of Lunar and Solar Eclipse

Chapter X	..	**Relating to the Heliacal Rising and Setting of the Planets.**
Chapter XI		Relating to the Conjunctions of the Planets.
Chapter XII		Relating to the Conjunctions of the Planets and Stars
Chapter XIII		Relating to the Visibility of Moon
Chapter XIV		Relating to the Vyatipata and Vaidharita

3 CORRECTION OF THE MANUSCRIPT·

There were many serious mistakes in the Arabic manuscript, especially in the formula for calculating *ahargana* or Day-Number, due to which the whole book had become useless for practical purposes, few remarks by unknown persons were also given on the margin of this manuscript indicating that certain formulae of this book did not give correct results, but no-body was able to find out the actual mistakes Now I have found out the real source of errors and have corrected the text accordingly Some examples of such corrections made by me in *Ghurrat-uz-Zījāt* are given in the following paragraphs

The most serious mistake committed by al-Bīrūnī is the wrong calculation of ahargana or Day-Number of the selected date 29 Naisan 1336 Roman era corresponding to 29 April 1025 A D (Thursday) For this date he had wrongly calculated the Indian date as 27th *tithi* of Jeshtha 948 Shaka-kala instead of 29th *tithi* of Vaishakh 947 Shaka-kala (as per Amanta system of reckoning) or 14th *tithi* of Jeshtha 947 Shaka-kala (as per Purnimanta system of reckoning), because he was confused in Amanta and Purnimanta systems of reckoning which are very complicated and difficult to understand, similar confusion can also be noticed in his *Kitab al-Hind* especially where he has described the dates of the Indian Festivals

Due to this mistake he had wrongly calculated the *ahargana* (or the Day-Number since the reference date of *Ghurrat-uz-Zījāt* which is 23 March 966 A D Saturday) as 21614 instead of the correct *ahargana* 21586, thus making a mistake of 28 days, and due to this mistake of 28 days all the formulae established by al-Bīrūnī on the basis of this wrong *ahargana*, especially for finding out the dates of various calendars, had gone absolutely wrong The date of Islamic calendar corresponding to the above mentioned Roman date was also wrongly given by al-Bīrūnī as 25 Ṣafar 416 A H instead of 27 Ṣafar 416 A H as per visibility of New Moon, this mistake was also due to some misunderstanding or due to lack of time to check the whole text again Now I have removed all these mistakes from the main text as well as from the solved examples and have compiled a corrected text of *Ghurrat-uz-Zījāt* Actually the reference date of *Ghurrat-uz-Zījāt* corresponds to 2073972 2895 Julian Day-Number, therefore if we deduct this figure from the Julian Day-Number of any date, we get the *ahargana* or the Day-Number of *Ghurrat-uz-Zījāt*.

As per the basic conception of *Ghurrat-uz-Zījāt* 1955884067 solar years or 714403782134 civil days had passed since the creation of the whole—Universe up to the reference date of *Ghurrat-uz-Zījāt*, i e , up to 23 March 966 A D (Saturday)

As can be explained by analysing the basic formula given in *Ghurrat-uz-Zījāt*, its *ahargana* is based on *Surya Siddhanta* and not on *Pulisa Siddhanta* as wrongly supposed by Dr Sachau and Dr Schramm (vide *Alberuni's India* 1910, Vol II page 375, Annotations), consequently the figure 69601 as suggested by them is wrong and the figure 64106 as given by al-Bīrūnī is correct

Another mistake committed by al-Bīrūnī was that he had supposed the measure of a yojana equal to 32000 Arabian cubits instead of 16000 Arabian cubits, similar mistake has been made by him in his *Kitāb al-Hind* (vide Alberuni's India, 1910, Vol I, page 167) In fact the yojana used by common people of India at that time was equal to 32000 cubits, but the yojana used by the astronomers was equal to 16000 cubits (one cubit being equal to 1 61825 feet), but al-Bīrūnī could not make a distinction between the two types of yojanas due to some confusion In *Ghurrat-uz-Zījāt* the diameter of Earth is said to be 1600 yojanas and the circumference is said to be 5028 yojanas which are equal to 7840 miles and 24637 miles respectively (one yojana being equal to 4 9 miles), the modern values of mean diameter and mean circumference of Earth as per reference ellipsoid 1967 are 7918 miles and 24874 miles respectively, this subject will be described in more details in the second part of this paper under the caption al-Bīrūnī's Measurements of Earth's Dimensions

Another correction made by me in *Ghurrat-uz-Zījāt* is that I have deleted the wrong Table of 28 Yogas given by al-Bīrūnī in one of his solved examples and have substituted the correct Table of 27 Yogas in place of the wrong Table, these two types of Yogas are altogether different from one another and this mistake of al-Bīrūnī is just a slip of pen due to the hurry in which he has written this book, because he was quite conversant with these two types of Yogas as mentioned by him in his *Kitab al-Hind* (vide Alberuni's India 1910, Vol II, page 210)

I have also corrected the mistake of al-Bīrūnī in the calculations of Karanas where he has wrongly supposed that *tithi* Amavasaya comes in the beginning of Shukla Paksha, but in actual fact *tithi* Amavasaya comes in the end of Krishna Paksha Exactly the same mistake has been made by al-Bīrūnī in his *Kitab al-Hind* (vide *Alberuni's India* 1910 Vol II, pages 197, 198, and 200) Here again he was confused due to the complicated determination of various Karanas which, actually are half-portions of a *tithi* Even Dr Gorukh Prasad of Allahabad University, U P (India) has recently made a similar mistake (vide his Hindi book on History of Indian Astronomy, chapter 18, page 266)

4. ACCURACY OF CALCULATIONS

The formulae and calculation mentioned in *Ghurrat-uz-Zījāt* by al-Bīrūnī are so accurate that this book can be safely adopted for ordinary practical purposes even today after the lapse of a thousand years Just to give an idea of the accuracy of this book as compared with the modern results I am giving the following Table which shows the comparative values (in terms of civil days) of the periods of different planets (i e , the time of one complete revolution of a Planet)

Periods of Planets in Civil Days

Name of the Planets	Periods as per Ghurrat-uz-Zījāt (in civil days)	Periods as per modern Astronomers (in civil days)
Sun (or Earth)	365 25875	365 2563612
Moon	27 32167	27 32166148
Mercury	87 9697	87 96925
Venus	224 69792	224 7007869
Mars	686 9975	686 9796458
Jupiter	4332 3206	4332 58482
Saturn	10765 773	10759 2198174

5 AL-BIRUNI'S PREDICTION ABOUT HIS DATE OF DEATH

Al-Bīrūnī was not only a great astronomer and astrologer as mentioned above, but he was a good spiritualist too, and it will not be out of place here to say something about this aspect also A glimpse of his spiritual vision can be seen from an event in which he had predicted his date of death while writing a letter to one of his friends Now-a-days there is no controversy about his date of birth which is the morning of Thursday, the 4th of September 973 A D corresponding to 3 Zilhijja 362 A H , but there is a controversy about his date of death, and I think this problem can be solved on the basis of his own prediction as described below

Probably in October 1036 A D corresponding to Zilhijja 427 A H he had written a letter in Arabic to his friend from which the English translation of few quotations is given below This letter is preserved in the Library of Leiden

"At present my lunar age is 65 years and solar age is 63 years.. when my age entered the 61st year, I saw a dream one night that I am trying to ascertain the places of visibility of Crescent and disappearance of Moon, but I am not able to visualize it In the same state some invisible personality told me GIVE IT UP, YOU ARE ITS SON FOR ONE HUNDRED AND NINETY TIMES After that when I awoke, I converted these lunar 15 years 10 months into solar years and months by deducting 5-1/2 months . "

Although al-Bīrūnī has not mentioned the exact date of this dream in his letter, yet from the other data given by al-Bīrūnī himself I can clearly visualize that this dream was seen by him at the night between 21 and 22 July 1034 A D (i e, between Sunday and Monday) corresponding to 2 and 3 Ramzan 425 A H At that time his age was in the 61st solar year as mentioned in his letter, i e, 60 years 10 months 17 days (solar) and 62 years 8 months 29 days (lunar), that was the night when he was informed by some spiritual power that his remaining age was 190 lunar months or 15 years 10 months (lunar)

In order to convert these 15 years 10 months (lunar) into solar years and months we deduct 5-1/2 months (lunar) and get 15 years 4 months 15 days (solar), because the difference between the lunar and solar periods can be obtained approximately if we multiply the lunar months by 11/380 More accurately, one lunar month consists of 29 5305888 days, so that 190 lunar months consist of 5610 81182 days Similarly one solar year consists of 365 242195 days, so that the total solar period comes to 15 years 132 days If we add this solar period to 21 July 1034 A D (which is the solar date of his dream), we get 30 November 1049 A D, which must be the probable solar date of his death Similarly if we add 15 years 10 months (lunar) to 2 Ramzan 425 A H (which is the lunar date of his dream), we get 2 Rajab 441 A H which must be the probable lunar date of his death

In view of the above mentioned facts, I can definitely conclude that the correct date of death of al-Bīrūnī, as predicted by himself about 15-1/3 years earlier, is the Night of 30 November 1049 A D, corresponding to 2 Rajab 441 A H (i e, the night of 3 Rajab), Thursday (i e, the night of Friday) It can also be the night of 2 Rajab if the crescent was sighted one day later at the horizon of Ghaznah due to dust or clouds It should be borne in mind that according to Islamic calendar the dates and days always change with effect from the time of local sunset This is the date which satisfies nearly all the statements given by various authorities, such as the facts of "2 Rajab" and "Friday-night" etc The commonly believed date of death i e, 2 Rajab 440 A H corresponding to 11 December 1048 A D appears to be incorrect, because it does not give Friday-night, it rather gives Monday-night which is not supported by any contemporary statement In this way the total length of his life comes to 76 years 2 months 26 days (solar) and 78 years 6 months 29 days (lunar)

AL-BIRUNI'S MEASUREMENTS OF EARTH'S DIMENSIONS

1. INTRODUCTORY NOTE

It is a well-known fact that from time immemorial people have been trying to find out the real shape and dimensions of Earth For this purpose many attempts had been made in the ancient times by the scholars of Greece, India, Egypt and Middle East Different results were obtained at different periods of times by different scholars Abū-Raiḥān-Muḥammad-Ibn Aḥmad al-Bīrūnī had also made a very successful attempt, perhaps in the year 1018 A D., to measure the radius and circumference of Earth while he was in detention in the ancient Fort of Nandna, which is situated in the hilly area of the famous Salt Ranges in District Jhelum, Tehsil Pind Dadan Khan, about five miles north of Dharíala Jalop in Pakistan Dharíala Jalop is situated on Jhelum-Pind Dadan Khan Road, about 42 miles from Jhelum The approximate latitude of Nandna as given by al-Bīrūnī himself is 32° N, but more accurately as determined from Survey of Pakistan topographical map, the latitude and longitude of Nandna Towers are 32° 43′ N and 73° 14′ E respectively, the difference is mainly due to the different points of reference selected by al-Bīrūnī and Survey of Pakistan for observations

Al-Bīrūnī obtained marvellously accurate results at that time by a very simple method which did not require an elaborate arrangement comprising large survey parties to work for several months and travel hundred of miles as was being done previously in different countries to measure the distance of one degree of latitude along the meridian on the surface of Earth with the help of the Pole Star As explained by him in his *Qānūn al-Mas'ūdī*, Volume II Chapter VII page 528, his simple method consisted of only two steps, in the first step he measured the height of a peak which was overlooking towards the dead-level plains, and in the second step he measured the angle of the dip of visible horizon from the same peak This whole process could be completed only by one person single handed within few hours The idea of this method had been suggested previously by Abū Ṭayyib Sind Bin Alī, the famous astronomer of the Court of Caliph Ma'mūn-ur-Rashīd, but he himself could not employ this method successfully, because he could not get an ideal site for it But al-Bīrūnī was fortunate enough to get that ideal site at Nandna and he did not miss the chance to make use of it The result obtained by al-Bīrūnī about a thousand years ago is so astonishingly accurate that even if we compare it with the most modern result, there is only a negligible error of minus 0 19 per cent, as will be explained later

2 IDEAL SITE

As is seen in the photograph of Nandna Fort Area taken by me, there is a high peak in the background towards south-west, and the highest point of this peak is 1795 feet high from mean sea level This highest point indicates the

spot from where al-Biruni had measured the angle of dip of horizon towards the south in order to measure the dimensions of the globe of earth In the foreground of this photograph there are the ruins of an ancient temple and an old mosque which indicate the site of the old Nandna Fort where al-Biruni was kept in detention This site of Nandna Fort also is also on a hill which is about 1500 feet high from mean sea level, and there is a deep gorge between this hill and the hill which is seen in the background This hill is quite different from the famous hill situated near Jhelum towards Dina and known as Tilla Balanath or Tilla Jogiyan Some scholars have erroneously supposed this Tilla Jogiyan to be the Nandna Hill, but this supposition is totally incorrect It is a matter of pride for me that, for the first time after the times of al-Biruni, I am indicating the correct location of Nandna Hill in this Paper I have myself named this 1795 feet high peak, seen in the background, as "al-Biruni's Peak", and have constructed a small monument at the top to conmemorate the marvellous and unique experiment of al-Biruni Many photographs of this area have been taken by me and, based on one of these photographs, the Government of Pakistan has recently issued few postage stamps on which this al-Biruni's peak is seen in the background and the ruins of Nandna Fort area are seen in the foreground An imaginary portrait of al-Biruni has also been printed on these postage stamps in a separate place

If you see the sketch showing contours of Nandna area, you will find that towards the south-south-west from the site of Fort Nandna, where al-Bīrūnī was kept in detention by Sulṭān Maḥmūd of Ghazna for the reasons best known to him, there is a very high peak which overlooks the southern plains which extend to several hundred miles The situation of the peak is ideal for the measurement of the angle of dip of southern horizon, because it is clear of any hindrance by any other peak in the way So it was this peak which was selected by al-Bīrūnī for his marvellous experiment

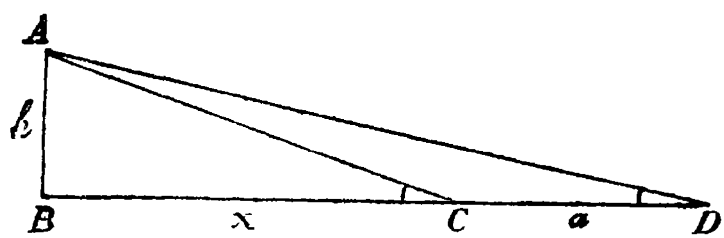
As is evident from the sketch showing contours of Nandna Area, the height of this peak selected by al-Bīrūnī is approximately 1795 feet above mean sea-level and it overlooks the southern plains which are at an average height of approximately 740 feet above mean sea-level The height of this peak with respect to the southern plains as found out by al-Bīrūnī by simple trigono-metrical method was 1055 18 feet which fairly tallies with the modern contours of that area

If a straight line is drawn from the above mentioned peak in the southern direction, immediately a sudden steep fall of about 1055 feet will be noticed and then the line will pass through the dead-level plains of the three main rivers of West Punjab for several hundred miles This line will first cross the river Jhelum at a distance of about 10 miles from the peak, then it will cross the river Chenab near Chiniot at a distance of about 60 miles from the peak, then it will cross the river Sutlej near Burewala at a distance of about 170 miles from the peak, then it will cross the border of West Pakistan near

Fort Abbas at a distance of about 250 miles from the peak, and then it will enter the Indian Territory and will pass through the desert of Rajasthan This shows that the site of observation selected by al-Biruni was an ideal one The height of the peak of observation with respect to the adjoining plain was only 1055 18 feet, therefore the distance of the visible horizon from the peak was only 39 miles approximately, which falls a bit East of Kot Mumin situated between the rivers Jhelum and Chenab The site was so ideal that even if the height of the peak were 10 miles (which is not possible on Earth), the distance of the visible horizon over the level plains throughout would have been 250 miles approximately i e , in the vicinity of Fort Abbas situated near the Eastern border of West Pakistan, and then the result obtained would have been even more accurate

3. ACTUAL EXPERIMENT

First of all al-Bīrūnī came down to the southern plains and measured the height of the peak from there by the following simple and easv method



As shown in the above figure, he selected a place C and from this place he measured the angle of elevation of the peak A by means of his self-made theodolite, let this angle be called "C" Then he moved farther from the peak to another place D in the same straight line BCD where B represents the base of the peak From the place C also he measured another angle of elevation of the peak, and let this angle be called "D' Let the height of the peak AB be denoted by "h" the distance BC be denoted by "x" and the distance CD which had been accurately measured by al-Bīrūnī be denoted by "a', so he found out the unknown accurately measured by al-Bīrūnī be denoted by "a' , so he found out the unknown value "h" by means of the known values ' C , "D" and "a", by the following formula –

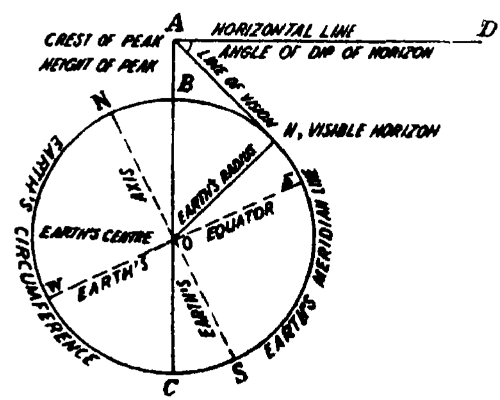
$$h = \frac{a}{\cot D - \cot C}$$

The values of cot D and cot C were obtained by him from his self-made Tables of Tangents as given in his *Qānūn-al-Mas'ūdī*, Volume I, Chapter VIII page 371 This Table of Tangents, and also the Table of Sines prepared by al-Bīrūnī could give the values correct to 7 to 10 places of decimal which was also a great achievement on his part, especially in the case of small angles The known

values of the angles "C" and "D", and the distance "a" have not been given by al-Bīrūnī but these can easily be found out now by practical experiments He has given the calculated value of the height "h" as 652-1/20 cubits, but more accurately it was 652—3′—18″ cubits as can be seen from his actual calculations of the radius of Earth, this quantity when converted into lowest sub-divisions of "1/60th" system, becomes 2347398″ cubits and when converted into decimal system it becomes 652 055 cubits

After finding out the height of the peak with respect to the adjoining plains, he climbed that peak and while looking towards the south he measured angle of dip of horizon as 34′ minutes of a degree Then he found out the values of sine 34′ and cos 34′ from his self-made Tables of Sines (vide his *Qānun-al-Mas'ūdī* Volume I Chapter VI page 308) as 0′—35″—36‴—14⁗—40′′′′′ and 59′—59″—49‴—2⁗—28′′′′′ respectively, which when converted into decimal fractions become 0 0098900205 and 0 9999492644 respectively, and when converted into the lowest sub-division of "1/60th" system becomes 7690480′′′′′ and 777560548′′′′′ respectively In this "1/60th" system he values are given in the form of divisions or sub-divisions of 1/60th parts upto anyl ower sub-divisions required The values given by al-Bīrūnī are upto 5th sub-divisions of 1/60th parts which can be easily converted into decimal fractions if the sub-divisions are divided by 60′ × 60′ × 60′ × 60′ ×60′= 777600000′′′′′ whicha ctually represents the sinus-totus or Sine 90°, or "1"

Then he calculated the radius of Earth in the following simple way



'In the above exaggerated diagram suppose BNCHS is the circumference of Earth, AB is the perpendicular height of the peak A, OH=OB is the radius of Earth, AH is the line of vision from the peak A to the visible horizon H, AD is the horizontal line as seen from the peak, DAH is the angle of dip of horizon which is 34′ in this case, HAO is the complementary angle of the dip of horizon Now in the right angled triangle AHO, AO is the hypotenuse and if it is supposed to be sinus totus, its value can be taken as "1" or 777600000′′′′′

Then OH=OB=Sine of angle HAO=cosine of angle DAH=cosine of angle of dip of horizon=cosine 34′=777560548′′′′′ Hence AB=AO - OB=sinus totus *minus* cosine 34′=777600000′′′′′—777560548′′′′′=39452′′′′′ NS is the axis of Earth, and EW is the equator of Earth

$$\text{Now, } \frac{OB}{AB} = \frac{777560548'''''}{39452'''''}, \text{ or } OB = \frac{AB \times 777560548'''''}{39452'''''}, \text{ but OB is}$$

the radius of Earth and AB is the height of the peak, therefore,

$$\text{Radius of Earth} = \frac{2347398' \times 777560548}{39452} \text{ cubits}$$

$$= \frac{1825244075254104''}{39452} \text{ cubits}$$

$$= 46264931442'' \text{ cubits}$$

$$= 12851369\text{-}50'\text{ - }42'' \text{ cubits}$$

After finding out the above value of radius of Earth he calculated the circumference of Earth as 80780039-1′-33′′ cubits and length of one degree of latitude equal to 1/360th part of the circumference i e 224388-59′-50′′ cubits An Arabic mile is equal to 4000 cubits and a cubit is equal to 1 61825 feet or one Arabic mile is equal to 1 225947 English miles (vide Encyclopedia of Islam by Dr Arnold), therefore one degree of latitude is equal to

$$\frac{1\ 61825 \times 224388\text{-}59'\text{-}50''}{5280},$$

$$= \frac{363117\ 4947}{5280} \text{ English miles}$$

$$= 68\ 772 \text{ English miles}$$

4 COMPARISON OF VALUES

Just like other scholars of his time, al-Bīrūnī had also considered the globe of Earth as a sphere and as such he had calculated the length of one degree of latitude on the surface of the sphere Whatever value he had found out at about 32°N latitude, he thought that the same value was true for any place between the Equator and the Poles But in modern times it is revealed that Earth is not a perfect sphere and is slightly flattened at its North and South Poles The actual figure of the earth is an irregular surface, and is not suitable for expressing the position of points on it In order to specify positions of points on the earth and to carry out various calculations, a regular geometrical figure known as reference spheroid or ellipsoid is introduced, which

is a surface formed by the revolution of an ellipse about its minor axis The science which deals with the shape and dimensions of the earth is known as geodesy and is very much developed in these days But in the days of al-Bīrūnī the world knew very little about geodesy and it was a very courageous step taken by him to undertake such a highly technical task about a thousand years ago

Now it has been practically determined that the length of one degree on the same meridian is not the same throughout as thought by ancient scholars, but it varies from latitude to latitude, it is minimum at the Equator and gradually increases towards the Poles, at Poles it is maximum In view of this fact the correct way to judge the accuracy of the values of one degree, obtained by the ancient scholars at different latitudes, is to compare these values with the corresponding values obtained by the latest method

For the sake of comparison we take two more values prevalent at that time, in addition to the value of al-Bīrūnī One value was obtained by a party of astronomers of Caliph Ma'mūn-ur-Rashīd in a plain desert near Moṣal between 36°N and 37°N latitudes and was 56-2/3 Arabian miles per degree, which amounts to 69 470 English miles per degree This value was considered to be the standard value in the Middle East at the time of al-Bīrūnī Similarly in India the standard value at that time, as given in *Ghurrat-uz-Zījāt*, was 13-29/30 yojanas per degree, and this value was verified by Vijaya Nandi, the author of Karana Tilaka, in the plains near Varanasi between 25°N and 26°N latitudes As one yojana is equal to 16000 cubits or 4 9 English miles, this value amounts to 68 436 English miles per degree Lastly the value determined by al-Bīrūnī by the simplest method between 32°N and 33°N latitudes was 68 772 English miles as already explained

In modern times the values of meridian lengths per degree of latitude determined on the basis of the latest reference ellipsoid 1967 are considered to be the most accurate values The dimensions of this reference ellipsoid 1967 are based on the values of the astronomical constants as adopted by the International Astronomical Union in 1964 In this ellipsoid the equatorial semi axis is 6378 160 kilometres, the polar semi axis is 6356 775 kilometres, flattening is 0 0033529237, and square of eccentricity is 0 00669460532856 As per the calculations of this ellipsoid and taking 1 kilometre equal to 0 621372 English miles the length of one degree of meridians between 36°N and 37°N latitude is 68 954 English miles, between 25°N and 26°N latitude it is 68 837 English miles, and between 32°N and 33°N latitude it is 68 909 English miles

So if we compare the value of the astronomers of Caliph Ma'mūn-ur-Rashīd i e , 69 470 miles per degree with the latest value at the same latitude i e , 68 954 miles per degree, we find a plus error of 0 516 miles which amounts to 0 75 per cent positive error, if we compare the value of Indian astronomers

i e, 68 436 miles per degree with the latest value at the same latitude i e 68 837 miles per degree we find a minus error of 0 401 miles which amounts to 0 58 per cent negative error, and if we compare the value of al-Bīrūnī i e 68 772 miles per degree with the latest value at the same latitude i e 68 909 miles per degree, we find a minus error of 0 137 miles which amounts to 0 19 per cent negative error In this way we see that the value of al-Bīrūnī is much more accurate than the other two values, because in the value of Indian astronomers the percentage error is nearly three times more than that of al-Bīrūnī, and in the value of Ma'mūn's astronomers the percentage error is nearly four times more than that of al-Bīrūnī The scholars can very well appreciate how easily the wonderfully correct value was obtained by al-Bīrunī about a thousand years ago, in spite of many practical difficulties in his way, which will be explained later

Although it will not be fair to compare al-Bīrūnī's values in the following manner, yet we are giving few more ordinary comparisons for general interest As per al-Bīrūnī the circumference of Earth comes to 24757 92 miles and as per reference ellipsoid 1967 the mean circumference, by the standard formula, comes to 24873 75 miles, the difference is only 115 83 miles Similarly, the Earth's radius as per al-Bīrūnī is 3938 77 miles and as per reference ellipsoid 1967 the mean radius is 3958 78 miles, the difference is only 20 01 miles The so-called radius of Earth calculated by al-Bīrūnī as 3938 77 miles is actually the radius of curvature of the meridian at about 32°N latitude, so if we find the latest value of the radius of curvature as per reference ellipsoid 1967 at 32°N latitude by the relevant formula, we get 3947 80 miles, the difference is only 9 03 miles, which is a negligible error

It will not be out of place to mention here that this correct measurement of Earth's dimensions by al-Bīrūnī was about 700 years before the French scientist Picard came to the conclusion about the correct circumference of Earth Before him, the European scientists and mathematicians including Newton had believed that the circumference was 17000 miles Later Newton corrected his views and based his theories on Picard's experiments Had he known the achievement of al-Bīrūnī, he would have not faced all that trouble in formulating his Gravitational Laws, and theories of Planetary Motions

5 PRACTICAL DIFFICULTIES

There were tremendous practical difficulties and numerous sources of error in that unique type of experiment which al-Bīrūnī had performed at Nandna to find out the dimensions of Earth, but he had very scholarly managed to cover up all such drawbacks and shortcomings of the experiment It appears that Providence had also helped him in his bold step, because many minor types of errors, which could rise to a considerable extent if added together, had automatically nullified each other miraculously by having plus and

minus signs Here it is proved that "God Helps those who help themselves" In order to give an idea of the precautions which al-Bīrūnī had to take in performing the experiment, three main difficulties are described below The effect of atmospheric refraction etc , must have also been accounted for by al-Bīrūnī through his personal experience of such measurements while taking the reading of the distant horizon

The greatest difficulty of the experiment was to find out the exact value of the angle of dip of horizon which was very small, but the self-made theodolite of al-Bīrūnī could only read upto minutes of a degree by interpolation The manufacture of such a precision instrument in those days was itself a very great achievement of al-Bīrūnī The importance of this reading can be well realized by the fact that an error of 1 minute of a degree in the angle of dip of horizon at that stage could make an error of approximately 250 miles (average) in the calculated value of the radius of Earth But al-Bīrūnī had so accurately measured the angle of dip of horizon that there was no appreciable error in his final result

The second main difficulty of the experiment was to find out the most accurate value of the cosine of the angle of dip of horizon which was very small, but the self-made Table of Sines of al-Bīrūnī could not provide the requisite standard of accuracy The importance of this value can be well realized by the fact that an error of 0 000001 in the value of the cosine of the angle of dip of horizon at that stage could make an error of approximately 75 miles (average) in the calculated value of the radius of Earth But al-Bīrūnī had so judiciously found out the value of cosine of the angle of dip of horizon that there was no appreciable error in his final result

The third main difficulty of the experiment was to find out the correct height of the peak with respect to the effective level of the adjoining plains, but al-Bīrūnī was not in a position to take innumerable levels at very short intervals between the peak and the visible horizon which was about 39 miles away and then to calculate the effective level of the adjoining plains by the help of the graph of these innumerable levels The importance of the height of peak with respect to the adjoining plains can be well realized by the fact that an error of 1 foot in the height of peak could make an error of approximately $1\frac{1}{2}$ miles (average) in the calculated value of the radius of Earth But al-Bīrūnī had so intelligently selected an effective spot of the plains for his measurements of the height of the peak that there was no appreciable error in his final result

The fourth main difficulty of the experiment was to climb upto the highest point of the peak in question which is 1795 feet high The whole hill is barren, stony, thorny and steep, and it is very difficult to climb it I have climbed it several times in order to repeat the same experiment of al-Biruni by the help of

modern instruments, but every time I had to face tremendous difficulties There is another peak towards the east from Nandna Fort area which is 2185 feet high from mean sea level and appears to be more suitable for this experiment, but al-Biruni had rejected it, probably due to the fact that the climbing of this peak is much more difficult than the climbing of the previous peak

The fifth main difficulty of the experiment was that, from the top of this al-Biruni's Peak, the southern horizon could not be seen distinctly due to dust, mist and vapours of moisture etc Therefore it was very difficult for al-Biruni to measure the angle of dip of horizon For example, I had myself tried several times to observe the southern horizon from the top of al-Biruni's Peak, but every time I remained unsuccessful to take correct readings It was only at one fortunate occasion, when I was at the Peak, that the horizon could be observed distinctly and correct readings could be obtained easily On that fortunate day, there was a heavy rain for a very short time and then the clouds disappeared suddenly making the atmosphere very clear From these facts the difficulties of al-Biruni can be well imagined and his efforts can be well appreciated

CONTOURS OF NANDNA AREA

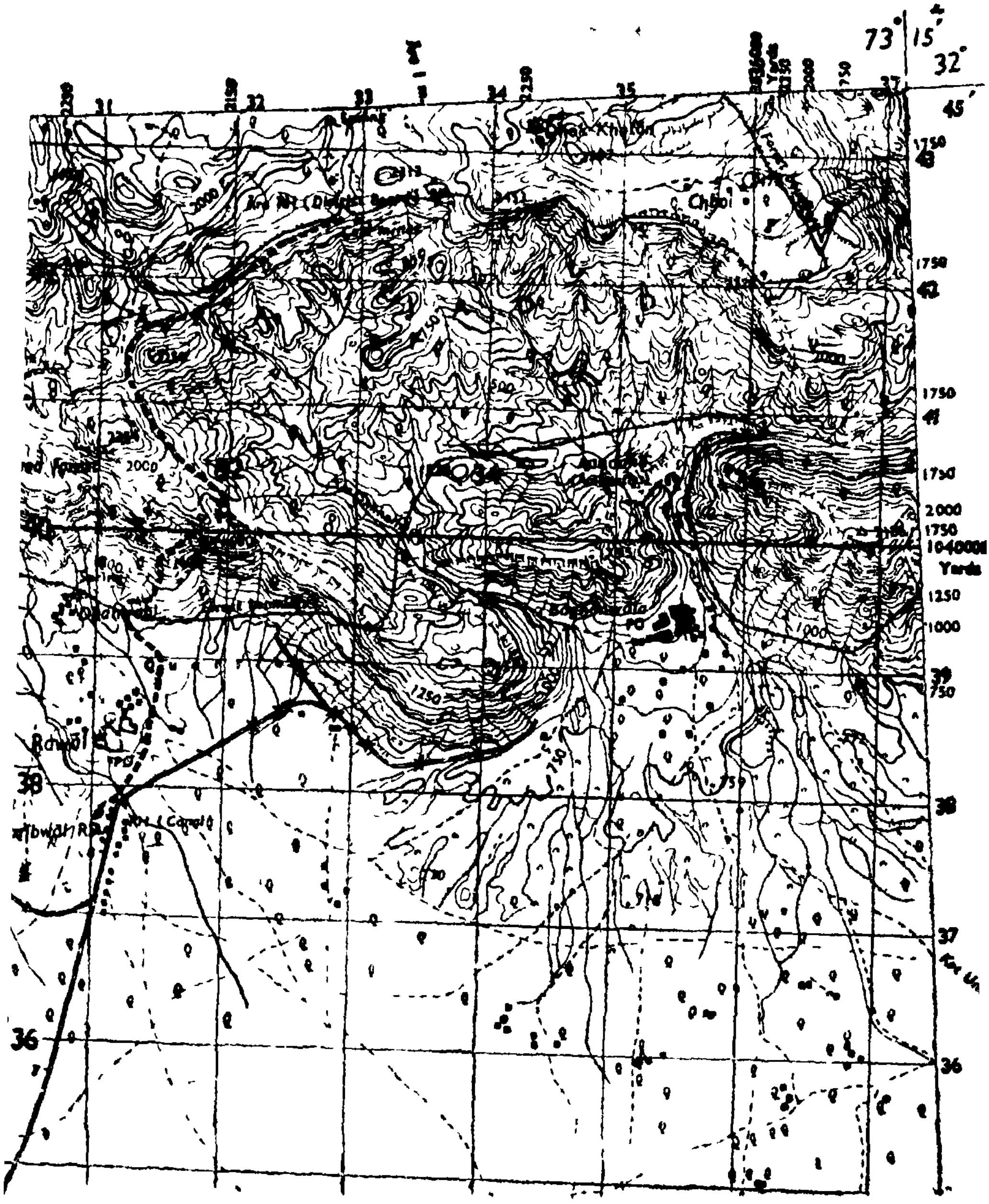
(*where al-Bīrūnī had accurately measured the Dimensions of Earth*)

Mean Grid North, in this sheet, is 2° 45′ East of True North

Magnetic Variation from True North about 1½ °East in 1960

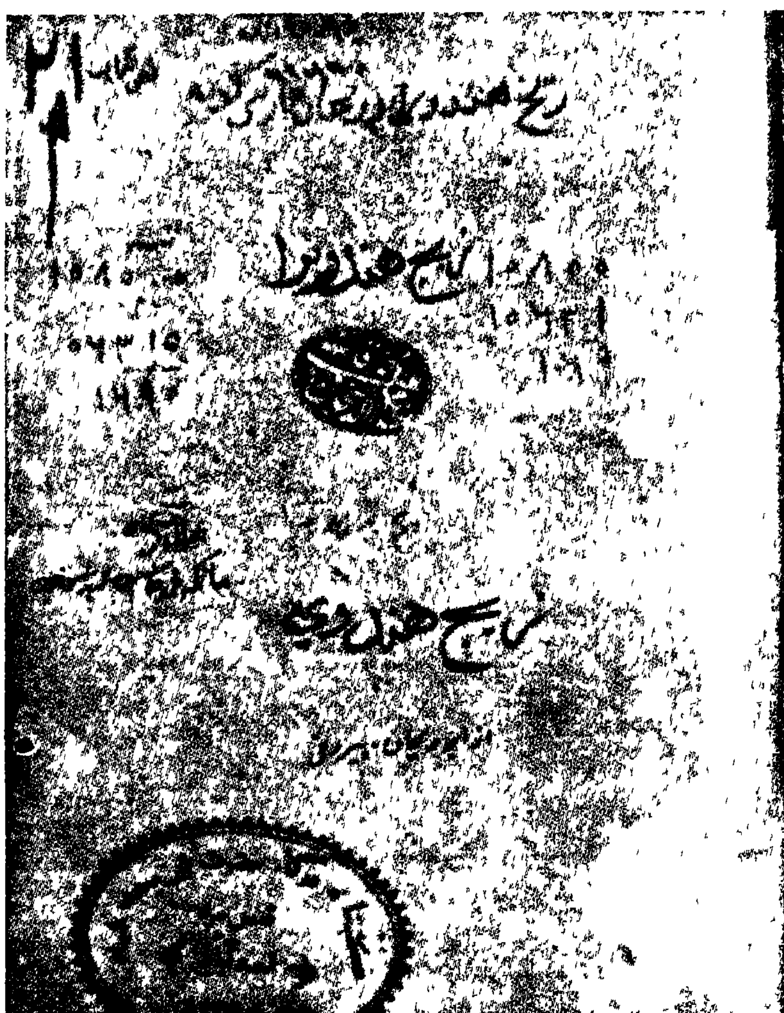
SCALE 1″ = 0 789 MILE

(Annual change negligible)



PHOTOS OF THE TITLE PAGE AND THE FIRST TWO PAGES OF AL-BĪRŪNĪ'S GHURRAT-UZ ZĪJĀT (ON INDIAN ASTRONOMY)

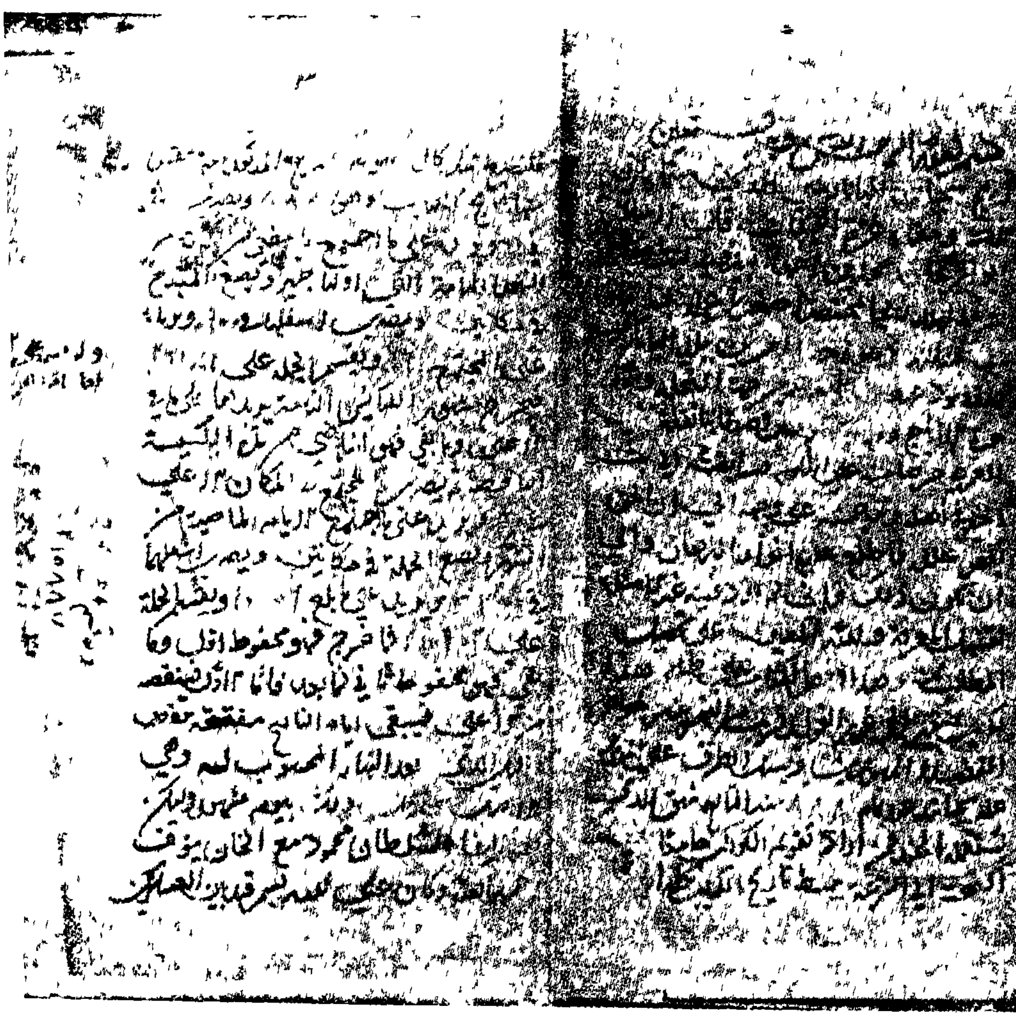
The original manuscript consisting of 68 pages is kept in the library of Dargah of Pir Muhammad Shāh at Aḥmadābād (India) and it is the only Manuscript in existence in the whole world. I had discovered it in the year 1959 and obtained its photos from India with great difficulties, its clue had been found out by me in the year 1953 from Dr Muḥammad Nāzim's famous book "*Life and Times of Maḥmūd of Ghazna*" published in the year 1931 by Cambridge University Press. (Vide its pages 55 and 239)



SPECIMENS OF RESEARCH WORK

ON al-BĪRŪNĪ'S GHURRAT-UZ-ZĪJĀT

(Published in Islamic Culture of Hyderabad, Deccan)



GENERAL VIEW OF NANDNA FORT AREA



As viewed towards south-south-west

(In the background is seen the peak from where al-Bīrūnī had accurately measured the dimensions of earth)

It would be a great surprise to the learned world, especially to the Orientalists, if I say that I am going to reveal to them the contents of a book which was considered to have been lost long ago From the writings of Abū Raiḥān Muḥammad al-Bīrūnī it was known that a very valuable book on Indian astronomy, named *Karana Tilaka*, existed at the beginning of the eleventh century A D and that it was very popular throughout India in those days Bīrūnī gave numerous quotations from this book in his various works, but nowhere did he specifically mention that he had completed an Arabic translation of the whole book Shankara Balkrishna Dixit had also declared in his well-known book on the History of Indian Astronomy that *Karana Tilaka* was no longer in existence anywhere in the world But now we find that a marvellous Arabic translation of this book made by Bīrūnī himself exists in the library of Dargāh of Pīr Muḥammad Shāh, Ahmadabad under the name of *Ghurraṭ-uz Zījāt* I consider myself most fortunate that I am placing this important book before the public for the first time

Bīrūnī has mentioned the name of *Karana Tilaka* or *Ghurrat-uz Zījāt* at many places and has given ample quotations from this work For instance, the following references may be seen

(1) كتاب تحقيق ما للهند Hyd Ed, p 121 (l 7), p 266 (l 16), p 280 (l 10), p 346 (l 18), p 384 (l 14), p 392 (l 17), p 410 (l 12), p 419 (l 10), p 420 (l 2), p 511 (ll and 19), p 513 (l 20)

(2) القانون المسعودی Hyd Ed, p 973 (l 7), p 1313 (l 15 and 20)

(3) تمهيد ا لمستقر Hyd Ed, p 27 (l.18), p 32 (l 4)

(4) افراد ا لمقال Hyd Ed, p 107(l 1), p 136 (l 8), p 152 (l 7)

So far as the Arabic manuscript of *Ghurrat-uz Zījāt* is concerned, I think it was first referred to by Dr Muḥammad Nāzim in his well-known work "*The Life and Times of Sultān Mahmūd of Ghazna*" published in 1931 by the Cambridge University Press On page 55 of this book is mentioned the date on which Sulṭān Maḥmūd and Khan Yūsuf Qādır Khān met near Samarkand, and a footnote says "This date is given by al-Bīrūnī in his unique and hitherto unknown work named *Ghurrat-uz Zījāt*" Again, in appendix O at page 239 of the same book a further clarification is given "*Ghurrat-uz Zījāt* being a translation into Arabic of the Sanskrit *Karana Tilaka* of Vijaya Nandi, son of Jayananda of Benares (Pīr Muḥammad Shāh's Dargāh Library, Aḥmadābād)"

From the above-mentioned references it is clear that the manuscript of *Ghurrat-uz Zījāt* kept in Pīr Muḥammad Shāh's Dargāh Library is a very authentic and valuable document, especially because its original Sanskrit book *Karana*

Tilaka has definitely been lost, and I have not been able to trace it anywhere The real importance of *Karana Tilaka* lies in the fact that it is a missing link between *Karana Khandakhadyaka* of Brahmagupta and *Karana Kutuhala* of Bhaskaracharya Shankara Balkrishna Dixit was very anxious to trace out a Karana based wholly on modern *Surya Siddhanta* so that its antiquity could be proved, but unfortunately he could not find it out Had he been alive today, he would have been extremely happy to see that his dream has taken a real shape in the form of the Arabic translation of *Karana Tilaka* which is entirely based on modern *Surya Siddhanta* And now we can say without any doubt that the so-called modern *Surya Siddhanta* is not 'modern' at all, it is much more ancient than the 10th century A D

Another important and interesting fact about *Karana Tilaka* is that according to it, the revolutions of Chandrochcha and Rahu in a Chaturyuga are respectively, 488211 and 232234, while these revolutions, according to the old *Surya Siddhanta*, are 488219 and 232226 and according to the modern *Surya Siddhanta*, are 488203 and 232238 By comparing the above-mentioned three different versions, we see clearly that *Karana Tilaka* is a connecting link between the old and the modern *Surya Siddhantas* It will not be out of place to mention here that Makaranda, the author of the famous *Makaranda Sarani* had further modified these revolutions to 488199 and 232242 respectively, in order to bring the calculated values closer to the observed conditions of solar and lunar eclipses It will be seen that the Chandrochcha revolutions are being gradually decreased while the Rahu revolutions are being gradually increased All this is being done to enable one to calculate the accurate time of a solar and lunar eclipse, but unfortunately the error has not been eliminated upto this time As a matter of fact the main reason for this error does not lie in the number of revolutions of Chandrochcha and Rahu, but it lies in the basic assumption that at the beginning of Kaliyuga all the mean planets were on the first point of Aries Actually the mean planets were not exactly on the first point of Aries at the beginning of Kaliyuga, they were at various distant places somewhere near the first point of Aries So if we want to rectify our calculations, we should modify our basic assumption and not go on changing the number of revolutions

Apart from the above mentioned facts, there are many other peculiarities of *Karana Tilaka* which will be described side by side with the translation of that book The original Arabic manuscript of *Ghurrat-uz-Zījāt* consists of single articles arranged serially, but I have divided the whole text into fourteen chapters and have also suggested an appropriate heading for each chapter I have not changed the order of the original text except at one or two places where it was considered most essential It appears that the original Sanskrit manuscript possessed by Bīrūnī was full of mistakes of the scribe and the same mistakes have consequently crept into its Arabic translation The Arabic scribe of the existing manuscript has made many mistakes in his turn Also

there are many mistakes in the solution of the numerical examples which are due to careless calculations most probably made by one of his disciples, because very often he used to get such tasks done by his pupils I have been able to correct all these and other mistakes in the text and have explained such corrections fully in the commentary on each article

The following is the list of contents of *Ghurrat-uz-Zījāt* or *Karana Tilaka* and its first two articles with translation and commentary

بسم الله الرحمن الرحيم

و به نستعين

ربح بحيا سد الفارسي الدى سماه كرن تيلک و معناه غرة الزيجات

فهرس الموضوعات

الباب الاول — فى استخراج الاصل من التواريخ المختلفة - (١) سبب تاليف الكتاب (٢) استخراج الأصل من التاريخ شک کال (٣) انتخاب التاريخ (٤) مثال لاستخراج الأصل من التاريخ شک کال (٥) استخراج تاريخ يزد جرد من هذا التاريخ (٦) استخراج تاريخ الهجرة من هذا التاريخ (٧) استخراج تاريخ الاسكندر من هذا التاريخ (٨) استخراج الأصل من احد هذه التواريخ الثلاثة (ا) استخراج الأصل من تاريخ الهجرة (ب) استخراج الأصل من تاريخ يزد جرد (ج) استخراج الاصل من تاريخ الاسكندر (د) استخراج شک کال من الأصل - (٩) معرفة اصحاب نوب الازمنة (الف) معرفة والى السنة (ب) معرفة و الى الشهر (ج) معرفة و الى اليوم (د) معرفة والى الساعة ،

الباب الثانى — فى استخراج اوساط النيرين و تقويمهما - (١) استخراج وسط الشمس (٢) استخراج وسط القمر (٣) استخراج اوج القمر (٤) استخراج وسط الراس و تقويمه (٥) معرفة تصحيح اوساط البلدان (٦) معرفة بعد الاوساط من نصف الليل الى وقت آخر (٧) استخراج جيب القوس (٨) استخراج قوس الجيب (٩) معرفة تقويم النيرين ٥

الباب الثالث — فى معرفة الاركان الخمسة - - (١) معرفة طول النهار و الليل (٢) معرفة منازل القمر (٣) معرفة يوم القمر من شهره (٤) معرفة الجوكات من الشهر (٥) معرفة كرنات فى الشهر ٥

الباب الرابع — في استخراج اوساط الكواكب الخمسة (١) معرفة استخراج وسط المريخ (٢) معرفة استخراج سرعة عطارد (٣) معرفة استخراج وسط المشترى (٤) معرفة استخراج سرعة الزهرة (٥) معرفة استخراج وسط زحل ○

الباب الخامس — في تقويم الكواكب الخمسة - (١) ذكر اوجات الكواكب (٢) معرفة استخراج تعديل الحصة (٣) معرفة استخراج تعديل الخاصة (٤) معرفة استخراج تقويم الكواكب الخمسة (٥) معرفة جهة الكواكب (٦) معرفة رجوع الكواكب و استقامتها (٧) جوزهرات الكواكب (٨) تعديل جوزهرات الكواكب (٩) استخراج عرض الكواكب ○

الباب السادس في الامثلة الثلثة (١) استخراج عرض القمر (٢) معرفة ميل القمر المعدل (٣) استخراج مقدار النهار (٤) معرفة خط نصف النهار (٥) معرفة عرض البلد من قبل ظل نصف النهار (٦) معرفة عرض البلد من ظل الاستوا (٧) معرفة ظل الاستواء من قبل عرض البلد (٨) معرفة تمام ارتفاع نصف النهار (٩) معرفة سهم النهار (١٠) معرفة الماضي من النهار من قبل الظل في الوقت (١١) معرفة الظل في الوقت من قبل الماضي من النهار (١٢) معرفة مطالع البلاد (١٣) معرفة الطالع من الماضي من النهار (١٤) معرفة الماضي من النهار من قبل الطالع ○

الباب السابع في خسوف القمر (١) معرفة مقدار السمرين (٢) معرفة مقدار الراس (٣) معرفة خسوف القمر ○

الباب الثامن - في معرفة كسوف الشمس ○

الباب التاسع - في جدول انحراف التصوير ○

الباب العاشر - في ظهور الكواكب و اختفائها ○

الباب الحادى عشر — في معرفة اجتماع الكواكب (١) معرفة مقادير الكواكب (٢) معرفة اجتماع الكواكب ○

الباب الثاني عشر في معرفة اجتماع الكواكب بالثوابت ○

الباب الثالث عشر في معرفة رؤية الهلال (١) معرفة رؤية الهلال (٢) معرفة ما مضى من القمر ○

الباب الرابع عشر في معرفة ثبات و بعد هرت ○

الباب الاول

فی استخراج الاصل من التواریخ المختلفة

(۱) سبب تالیف الکتاب :-

زیج بجیانند الفارسی الذی سماه کرن تلک و معناه غرة الزیجات - قال الاستاد ابو الریحان محمد بن احمد البیرونی کتب وجدت فی الهند زیجا مختصرا صغیرا عمله بجیانند بن جیانند و هو احد المفسرین ببلد البانارس المقصود عندهم بالتعظیم من جهة العلم و سماه غرة الازیاج واحب بعض اصدقائنا نقله الی العربی حرصا منه علی العلوم فساعدته الی بث الخیر فی اهله و ترجمته علی وجهه الی ان الحق ببعض علله فاطلع علیه انوار البرهان و الی ان تکون ذلک فانی لم ارد فیه غیر الامثلة لتسهل المعرفة و الله المعین علی تحصیل المطالب بمنه -،

(۲) استخراج الاصل من التاریخ شک کال :- .

و هذا نص الکتاب علی نظام - هذا کتاب صغیرا لحجم غزیر الفوائد قریب من الفهم یسر خواطر الفضلاء الماهرین و یستهل الطرق علی المبتدئین ، عمله بجیانند عند تمام ۸۸۸ سنة التاریخ الشق الذی یستعمله الهند - فمن اراد تقویم الکواکب جامعا فیه الصحة الی السرعة بسط تاریخ الکتاب کله ایاما فلیضع شک کال و هو مبنو التاریخ المذکور تامة و ینقص منها تاریخ الکتاب و هو ۸۸۸ و یضرب الباقی فی ۱۲ و یزید علی ما اجتمع ما مضی من السنة من الشهور التامة التی اولها جیتر و یضع المبلغ فی مکانین و یضرب اسفلها فی ۹۰۰ و یزید علی المجتمع ۶۶۱ و یقسم الجملة علی ۲۹۲۸۲ فیخرج شهور الکبائس التامة یزیدها علی ما فی الاعلی و ما بقی فهو الماضی من مدة الکبیسة الناقصة ثم یضرب المجتمع فی المکان الاعلی فی ۳۰ ویزید علی ما اجتمع الایام الماضیة من الشهر و یضع الجملة فی مکانین و یضرب اسفلها فی ۳۳۰۰ و یزید علی ما بلغ ۶۳۱۰۶ و یقسم الجملة علی ۲۱۰۹۰۲ فما خرج فهو محفوظ اول و ما بقی فهو محفوظ ثانی لما بعد — فاما الاول فینقصه من الاعلی فیبقی ایام التاریخ مفتتحة بنصف اللیل الذی بعد النهار المحسوب و هی الاصل -

CHAPTER 1– *Relating to Ahargana*

1. Karana Book of Vijaya Nandi of Varanasi the name of which is *Karana Tilaka* and its (Arabic) translation is *Ghurrat-uz-Zījāt*
2. The substance of the book and its arrangement
3. Selected date for the example
4. Example for the selected date
5. To find the date of Yazdjird era from this date

6 To find the date of the Hijra era from this date

7 To find the date of the Roman era from this date

8 To find the ahargana from the date of the Hijra era

9 To find the ahargana from the date of Yazdjird era

10 To find the ahargana from the date of the Roman era

11 To find the date of the Shaka-kala from the ahargana

12 To find the Lord of the year

13 To find the Lord of the month

14 To find the Lord of the day

15 To find the Lord of the hour

CHAPTER II—*Relating to the Sun and the Moon*

1 To find the mean place of the sun

2 To find the mean place of the moon

3 To find the place of Chandrochcha

4 To find the mean and true place of Rahu

5 Correction for the mean longitude of the place

6 Correction for any time other than the midnight

7 To find sine of an arc

8 To find the arc of a sine

9 To find true places of the sun and the moon

CHAPTER III—*Relating to the Punchanga*

1 To find the duration of a day and a night

2 To find the Nakshatra

3 To find the Tithi in a month

4 To find the Yoga in a month

5 To find the Karana in a month

CHAPTER IV—*Relating to the mean places of the Planets*

1 To find the mean place of Mars

2 To find the Budhochcha

3 To find the mean place of Jupiter

4 To find the Shukrochcha

5 To find the mean place of Saturn

CHAPTER V—*Relating to the true places of the Planets*

1 Uchchas of the planets
2 To find the Mandphala
3 To find the Shighraphala
4 To find true places of the five planets
5 Tc find true daily motions of the planets
6 To find retrogression and direction of the planets
7 Nodes of the planets
8 Equation of the nodes of the planets
9 To find the latitude of the planets

CHAPTER VI—*Relating to the three problems of Diurnal Motion*

1 To find the latitude of the moon
2 To find the true declination of the moon
3 To find the duration of a day
4 To find the meridian line
5 To find the latitude from the shadow at noon
6 To find the latitude from equinoctial shadow
7 To find the equinoctial shadow from the latitude
To find the co-altitude of the sun at noon
To find the versed-sine of the day
10 To find the past period of the day from the shadow at any time
11 To find the length of shadow at any time from the past period of the day
12 To find the duration of ascendants at any place
13 To find the ascendant from the past period of the day
14 To find the past period of the day from the ascendant

CHAPTER VII—*Relating to the Lunar Eclipse*

1 To find the measures of the moon and the sun
2 To find the measure of the shadow
3 Detailed description of the lunar eclipse

CHAPTER VIII—*Relating to the Solar Eclipse*

CHAPTER IX—*Relating to the shapes of the Lunar and Solar Eclipse*

CHAPTER X—*Relating to the heliacal rising and setting of the Planets*

CHAPTER XI—*Relating to the conjunctions of the Planets*

1 To find the measures of the planets

2 To find the conjunctions of the planets

CHAPTER XII—*Relating to the conjunctions of the Planets and Stars*

CHAPTER XIII—*Relating to the visibility of the Moon*

1 To find the visibility of the moon

2 To find the lighted portion of the moon

CHAPTER XIV—*Relating to the Vyatipata and Vaidharita*

CHAPTER—I

RELATING TO AHARGANA

1 *Karana Book of Vijaya Nandi of Varanasi the name of which is Karana Tilaka and its (Arabic) translation is Ghurrat-uz-Zījāt* –

Master Abū Raiḥān Muḥammad ibn Ahmad al-Bīrūnī said

"In India I came across a Karana book which was very concise and was written (in Sanskrit) by Vijaya Nandi, son of Jaya Nandi, one of the commentators of the city of Varanasi The Hindus have a high regard for it from the religious point of view and the author has named it as *Karana Tilaka* Some of my friends, who are fond of knowledge, have expressed their desire to get it converted into Arabic So I hasten to do this work in order to spread knowledge among those who deserve it I am translating it in such a way that its reasonings are expressed clearly, and with this aim in view I have not added anything from my own side except the examples which are meant to make the understanding of the subject easy And it is God Who, through His kindness, helps in achieving the objects "

COMMENTARY

(a) *Correction of the Manuscript*

No correction is required

(b) *Translation of the technical terms*

(i) *Ahargana* —It is a Sanskrit term which means "number of civil days" Bīrūnī has translated this term into Arabic as "*Asl*" meaning root or base, but I have preferred to use the original Sanskrit term in the English translation

(ii) *Karana Book* —It is the translation of the Arabic term "*Zij*" In English I could not find a suitable equivalent A Karana book is generally a book which is based on some astronomical canon known as Siddhanta, but it gives much easier methods of calculations as compared with those of Siddhanta As will be seen later, this Karana book is based on modern Surya Siddhanta

(iii) *Vijaya Nandi* —In the Arabic manuscript this name is written as "Bijaya Nand" but its correct pronunciation is the same as I have given in the translation This author flourished in Varanasi in the middle of the 10th century A D Another Indian astronomer of this name wourished in the 5th century A D or even earlier than that, Dr Edward C Sachau seems to have got confused, because he thinks both these astronomers identical although there is a time gap of more than five centuries between these two personalities (Vide *Al berūnī's India*, 1910, Vol II, page 306 Annotations)

(iv) *Varanasi* —In the Arabic manuscript this name is written as Banarasi, but I have preferred to write it as Varanasi, because it is more correct and at present also the city is known by this name This is a famous city of India situated on the banks of the river Ganges and its religious status is still maintained

(v) *Ghurrat-uz Zījāt* —This the Arabic translation of the Sanskrit name "*Karana Tilaka*," and Bīrūnī has himself mentioned this name in his Indica (vide Alberuni's India, 1910, Vol II, page 90) Dr Edward C Sachau has made a serious mistake in assuming this book to be identical with the *Kitāb-algu-rrah* (vide *Alberuni's India* 1910, Vol. II, page 388 Annotations), although at another place he clearly states that the title of Vijaya Nandi's book *Karana Tilaka* would be in Arabic *Ghurrat-uz-Zījāt* (vide *Alberuni's India*, 1910, Vol II page 345 Annotations) This name is given by Bīrūnī to his Arabic translation of *Karana Tilaka*

(vi) *Biruni*:—He was the most learned Muslim author of the early 11th century A D He wrote more than 150 books on various subjects and translated many Sanskrit books into Arabic The present book is perhaps the only Arabic translation of a Sanskrit book and probably the only manuscript available, but has hitherto been unknown to the world Bīrūnī had made this translation before writing his Indica, but he could not revise and rectify the manuscript afterwards, that is why he did not mention anywhere that he had made a translation of *Karana Tilaka* He quoted only those passages of this translation in his *Indica*, which he had verified from *Pulisa Siddhanta* available with him He did not quote those passages of this translation which were based on *Surya Siddhanta* because the *Surya Siddhanta* was not available with him and hence he could not verify the correctness of those passages Due to these unverified passages, he did not think it proper to mention the name of this translation as a complete and authentic work He, however, had given an indication of it in his letter to one of his friends nearly 13 years before his death, where he had mentioned that there were various incomplete translations of Sanskrit books with him at that time Bīrūnī was born in 973 A D and he died in 1048 or 1049 A D As stated in the *Encyclopaedia Britannica* and judged from his writings, Bīrūnī was a Shia by faith and believed in the twelve Imams His complete life has been given in the Urdu book named "*Alberuni*" written by Syed Hasan Barnī, who died on 16 October, 1959

(vii) *Commentator* —This is a literal translation of the Sanskrit term "*Tikakara*", for which Bīrūnī has used the Arabic word "*Mufassir*". In Sanskrit an *Acharya* is one who writes a Siddhanta on astronomical principles, but a *Tikakara* is one who merely follows the *Siddhantas* and, on the basis of these *Siddhantas*, writes a *Karana* book introducing easy calculations

(c) *Elaboration of the Principle*

No elaboration of any principle is required here

(d) *Explanation of the Text*

In this article Bīrūnī has expressed his views about the Sanskrit book *Karana Tilaka* written by Vijaya Nandi, son of Jaya Nandi of Varanasi From his statement it is clear that this book was very popular among the Hindus throughout the whole country It appears that in those days, that is at the beginning of the 11th century A D, it was the only Karana book which was considered a standard book by the Indian astronomers and astrologers Most probably the main reason for its popularity was that its calculations were based on the modern *Surya Siddhanta* which is considered by the Hindus as a revelation from Sun God to Maya Danava

It will be observed later on that even the ahargana of this book is based on the modern *Surya Siddhanta* and not on *Pulisa Siddhanta* as believed by Dr Sachau and Dr Schram (vide *Alberuni's India*, 1910, vol II, page 375, Annotations) The methods of calculations given in this book are so accurate that they can be adopted even today without any appreciable error, although the usual range of a Karana book is supposed to be only two or three centuries The most important fact about this book is that its text has proved the antiquity of the modern *Surya Siddhanta*, because it is based on it and now we can say without any doubt that the time of the so-called modern *Surya Siddhanta* is much earlier than the 10th century A D

Bīrūnī has not given a literal translation of the text of *Karana Tilaka*, he has given only a summary of this book in his own words By adopting this method of reproduction he has made a few mistakes because he had some wrong notions in his mind about certain technical terms of the Hindus such as *Tithi*, *Karana*, *Yoga*, etc Moreover, the Sanskrit manuscript possessed by Bīrūnī seems to be carelessly written and Bīrūnī has copied the same figures in his translation without any verification Such mistakes have been rectified by me in this English translation and full justification of this rectification has also been given

The most unfortunate part of it is that Bīrūnī could not get hold of a copy of the modern *Surya Siddhanta* as stated by him in his *Indica* (vide *Alberuni's India*, 1910 vol I, page 154), and therefore he could not verify many formulae mentioned in *Karana Tilaka* He could not even know that *Karana Tilaka* was actually based on the modern *Surya Siddhanta*, otherwise he would have stated this fact somewhere The solved examples given by Bīrūnī from his own side are very useful but are not free from petty mistakes of calculation, these mistakes have been rectified in the English translation At certain places such solved examples are not given by Bīrūnī, and so I have tried to give some additional examples in the commentary

(e) *Additional Examples*

No examples are required

2 THE SUBSTANCE OF THE BOOK AND ITS ARRANGEMENT

This book is small in bulk, important for use and easy to understand It enlightens the brains of big scholars and smoothens the path for beginners It is written by Vijaya Nandi at the end of the year 888 Shaka-kala which is in use amongst the Hindus

Any one who wants to compute the true places of the planets completely, correctly and quickly, should find out the total number of civil days since the

date of this book (upto the selected date) Take the complete years of Shaka-kala of the selected date and deduct from these the years of this book, i e 888 Multiply the remainder by 12 and add to the product the complete (synodic lunar) months of the current year of Shaka-kala beginning from (Shukla Pratipada of) Chaitra Put the sum at two places and multiply the lower one by 900, add to the product 661 and divide the sum by 29282, the quotient represents the number of complete *adhimasas* which are to be added to the number already kept at the upper place, the remainder represents the past period of the incomplete *adhimasas* (which is to be ignored, because only complete *adhimasas* are taken into account) Now multiply the sum at the upper place by 30 and add to the product the past *tithis* of the current month (at Lanka upto the midnight which follows the day you have selected) Put this sum at two places and multiply the lower one by 3300, add to the product 64106 and divide the sum by 210902 The quotient represents the first fixed number and the remainder represents the second fixed number Both these fixed numbers should be kept in memory, because these will be used later on (for computation of the Moon) Now deduct the first fixed number from the number already kept at the upper place, the remainder will represent the total number of civil days (passed since the date of this book at Lanka, upto the midnight which follows the selected day) This is the *ahargana*

COMMENTARY

(a) *Correction of the Manuscripts*

No correction of the manuscript is required, only a few phrases have been added within brackets to make the text more intelligible

(b) *Translation of the technical terms*

(i) *Shaka-kala* —This is an era which depends on solar years and is generally 78 years less than the Christian era, so that the year 1957 A D corresponds to 1879 Shaka-kala When we write 1957 A D , it means that 1956 years of the Christian era have passed and the 1957th year is current, but when we write 1879 Shaka-kala, it means that 1879 years of this era have passed and the 1880th year is current In other words, we always write the number of past years to indicate the Shaka-kala, but to indicate the Christian era we write the number of the current year This is just a convention Shaka-kala may be used either with solar months or synodic lunar months When used with solar months, the first month of the year begins when the sun passes the first point of Aries (without any regard to degrees of precession), and nowadays it generally happens on 14 April, the second month begins when the sun passes the first point of Taurus and it generally happens on 15 May, and so on But when this era is used with synodic lunar months, the first month of the year corresponds to

the first month of the year of Vikrami Samvat Vikrami Samvat also is indicated by the number of past years and it is 135 years longer than the Shaka-kala, so that 1879 Shaka-kala corresponds to 2014 Vikrami Samvat In *Karana Tilaka* the Shaka-kala is used with synodic lunar months and luni-solar years In this luni-solar system normally each year consists of 12 synodic lunar months, but generally after every two years the third year consists of 13 synodic lunar months in order to keep the luni solar years in step with the solar years If the synodic lunar month is reckoned from full moon to full moon, the arrangement is known as purnimanta, if the month is reckoned from new moon to new moon, this arrangement is known as amanta The purnimanta arrangement is used all over North India, and the amanta arrangement is generally used in South India Each month of purnimanta is divided into two parts, dark half and light half, but in the amanta arrangement each month is divided into light half and dark half From new moon to full moon it is light half and from full moon to new moon it is dark half In both purnimanta and amanta arrangements the light half of each month is identical, but in the purnimanta arrangement this light half is considered the second half of the month, the preceding dark half being the first half, and in the amanta arrangement this light half is considered the first half of the month, the succeeding dark half being the second half Thus, if we take the purnimanta arrangement then the month of Chaitra begins just after the full moon, generally occurring between the middle of March and the middle of April, but if we take the amanta arrangement, then the month of Chaitra begins just after the new moon, generally occurring in the month of March In this way the months of purnimanta arrangement begin nearly 15 days earlier than those of amanta arrangements, but the new year always begins in both the arrangements on the same day, i e , with the beginning of the light half of Chaitra Hence it will be seen that, according to the purnimanta arrangement, the new year begins from the middle of Chaitra and, according to the amanta arrangement, the new year begins from the beginning of Chaitra There are very elaborate methods of calculations for this luni-solar system and these will be explained at some other proper place The names of the synodic lunar months are given below in the correct order -

1 Chaitra
2 Vaishakha
3 Jyeshtha
4 Ashadha
5 Shravana
6 Bhadrapada
7 Ashwina
8 Kartika
9 Margashirsha
10 Pausha
11 Magha
12 Phalgana

(ii) *Tithi* —Each of the two halves of a synodic lunar month is divided into 15 parts and each 15th part is known as synodic lunar day or simply a *tithi* The light half is known as Shukla Paksha and the dark half is known as Krishna Paksha The last *tithi* of the light half is known as *purnima* and the last *tithi* of the dark half is known as *amavasaya* The names of the remaining 14 tithis are identical for both the halves and are given below —

1	Pratipada	8	Ashtami
2.	Dutiya	9	Naumi
3	Tritiya	10	Dashami
4	Chaturthi	11.	Ekadashi
5	Panchami	12	Dwadashi
6	Shashti	13.	Trodashi
7	Saptami	14	Chaturdashi

When the sun and the moon meet together at one point of the zodiac, it is the end of *amavasaya* and beginning of Shukla Pratipada, and when the sun and the moon come exactly opposite to one another at a distance of 180 degree of the Zodiac, it is the end of *purnima* and beginning of Krishna Pratipada In fact the time during which the moon moves 12 degrees away from the sun is one *tithi* and so in one synodic lunar month there are 30 *tithis* equivalent to one complete synodic revolution of the moon comprising 360 degrees A *tithi* may begin or end at any moment during day and night, but a civil day is generally named according to the *tithi* which is present at the time of sunrise of that day In the Hindu system a civil day is reckoned from sunrise to sunrise

(iii) *Adhimasa*:—As mentioned above, after every two years the third year consists of 13 synodic lunar months, instead of 12 The additional synodic lunar month is known as *adhimasa* and it may fall at any part of the year It is supposed that during each synodic lunar month the sun should transit one sign of Zodiac But every third year it so happens that the transit of the sun does not take place during any one synodic lunar month, such a synodic lunar month is known as *adhimasa* which is ignored for all religious purposes and so the next month is given the same name In this way two months of the same name are reckoned in one year and the actual number of months becomes 13, instead of 12 It is important to note that for the sake of finding out the transit of the sun during a month, the amanta arrangement is always used, and a synodic lunar month for this purpose is reckoned from new moon to new moon and not from full moon to full moon For example, if there is no transit of the sun in the Shukla Paksha of Chaitra, and its succeeding Krishna

Prakasha, then we will say that this Chaitra is an *adhimasa* and so its next month will also be named as Chaitra The first Chaitra will be considered inauspicious for all religious festivals, etc, but the second Chaitra will be considered just a normal month Very rarely after a very long time it may also happen that during one synodic lunar month there occur two consecutive transits of the sun In such cases the particular synodic lunar month is dropped from the serial order and is known as *kshaya-masa* Whenever a *kshaya-masa* occurs, there must occur two *adhimasas* in that year Such *kshaya masas* can only occur in the months of Kartika, Margashirsha, and Pausha, because the daily motion of the sun becomes maximum during these months

(c) *Elaboration of the Principle* -- The first and the main problem in computing the planetary positions is to find out the total number of civil days passed after a particular day upto the selected date In the Christian calendar this problem is very simple, but in the Hindu calendar of the luni-solar system this problem becomes a little complicated In this article a method is given by which the synodic lunar days or the *tithis* are converted into civil days and after making an allowance of tithis of *adhimasas*, the correct number of civil days passed is found out First the number of past solar years is found out and it is converted into solar months by multiplying it by 12, then the past synodic lunar months are also added to this solar month, and with the help of this sum the number of past complete *adhimasas* is calculated ignoring the remainder which represents the incomplete *adhimasa*, then these *adhimasas* are also added to the above-mentioned sum and then it is converted into a sort of mixed number of solar days and synodic lunar days by multiplying it by 30, and to this product the past tithis of the current month are added, then with the help of this sum the number of *tithis* in excess of the corresponding number of civil days is calculated ignoring the remainder which represents excess *tithis*, then these excess *tithis* are deducted from the above-mentioned sum and the remainder represents the number of civil days passed after a particular day fixed by the author of the book This number is known as ahargana

It will be observed that in the above-mentioned method at one place we add synodic lunar months to solar months, and at another place we add synodic lunar days to a sort of mixed number of lunar and solar days This is apparently a wrong process, but as neither of the two remainders in the two divisions is taken into account in calculating the ahargana, this irregularity does not affect the final result

(d) *Explanation of the Text* - The starting point for calculating the *ahargana* as fixed by Vijaya Nandi, the author of *Karana Tilaka*, is the midnight at Lanka at the beginning of Chaitra Shukla Pratipada 888 Shaka-kala

From this day the *ahargana*, or the number of civil days that have passed upto any selected day, is calculated to compute the planetary positions on the Zodiac This fixed moment corresponds to the midnight at Lanka between 23rd and 24th of March, 966 A D Julian In future references we shall always mention various dates with respect to the midnight under consideration and accordingly we may say that the above-mentioned first day corresponds to Saturday, the 23rd of March, 966 A D, 30 Isfindar-muz-Mah 334 Yazdjird, 28 Rabī'-ul-Awwal, 335 A H 23 Azar 1277, Roman era, and the *amavasaya* preceding Chaitra Shukla Pratipada 888 Shaka-kala On this particular day the *ahargana* of *Karana Tilaka* was zero, it was "1" on the next day, i e, on Sunday, the 24th of March, 966 A D, 1 Farwardin-Mah 335 Yazdjird, 29th Rabī'-ul-Awwal 355 A H ,24 Azar 1277, Roman era, and Chaitra Shukla Pratipada 888 Shaka-Kala (or 1023 Vikrami Samvat) In this way the *ahargana* increases by one from midnight to midnight at Lanka, if the *ahargana* is 1, it is Sunday, if it is 2 it is Monday if it is 3, it is Tuesday and so on

The location of Lanka is supposed to be at the equator of the earth and at 75° 45′ E longitude with reference to Greenwich, so if we suppose the beginning of each day of the Julian day number at the Greenwich mean noon, the above-mentioned fixed midnight corresponds to 2073972 28958 day of the Julian day number Similarly, the mean noon of the next day at Lanka when the ahargana of *Karana Tilaka* was "I" correspond to 2073972 78958 day of the Julian day number If we assume the number of days of the Julian day number as a whole number considering the decimal fraction as one, we may say that the first day of the ahargana of *Karana Tilaka* corresponds to the day 2073973 of the Julian day number

According to the modern *Surya Siddhanta* (vide English translation of *Surya Siddhanta* , 1935, edited by E Burgess, formerly missionary of the A B C F M in India), the number of civil days in a Chaturyuga is 1577917828, and within this period the number of complete cycles for the sun is 4320000 and for the moon it is 57753336 A Chaturyuga is subdivided into four smaller yugas, e g, Satyayuga, Tretayuga, Dwaparayuga and Kaliyuga The duration of these smaller Yugas in terms of solar years is 1728000, 1296000, 864000 and 432000, respectively The first three yugas of the present Chaturyuga have already passed and the fourth yuga, i e, the Kaliyuga, has started since B C 3102 or 3179 years before Shakakala At the beginning of Kaliyuga the mean places of all the planets were at the first point of Aries as per the supposition of Surya Siddhanta If we take more accurate figures, then the number of civil days that passed since the first midnight after which the Kaliyuga started up to the above-mentioned fixed midnight is 1485507, in other words, the Kaliyuga ahargana on 23 March, 966 A D, is 1485507 At the beginning of Kaliyuga also the mean places of all the planets were at the first point of Aries, and there was no incomplete *adhimasa*

From the above-mentioned figures it is clear that in a Chaturyuga there are 4320000 × 12 = 51840000 solar months and 57753336 — 4320000 = 53433336 synodic lunar months Therefore, the number of excess synodic lunar months or the *adhimasas* is 53433336 — 518400000 = 1593336 So the number of *adhimasas* in each solar month is $\frac{1593336}{51840000}$

In order to simplify this fraction we can select by inspection an easy whole number 900 as numerator, and its corresponding denominator (say D) can be found out in the following manner —

$$\frac{900}{D} = \frac{1593336}{51840000}$$

$$\text{or} \qquad D \quad \frac{900 \times 51840000}{1593336} = 29281 \frac{1528584}{1593336}$$

The fraction being equal to more than half can be taken as one, so that D = 29282 and therefore the fraction is $\frac{900}{29282}$

Now, the number of solar years that elapsed up to the beginning of 888 Shaka-Kala since the beginning of Kaliyuga is 888 + 3179 = 4067, it is equal to 4067 × 12 = 48804 solar months Hence the number of *adhimasas* that passed since the beginning of Kaliyuga up to the beginning of 888 Shaka-kala is

$$\frac{1593336}{51840000} \times 48804 = 1500 \frac{1170144}{51840000}$$

It shows that 1500 complete *adhimasas* had already passed and been accounted for, and only a fraction of 1501 st *adhimasa* had been accumulated This fraction is yet to be accounted for in all the calculations to be made since the beginning of 888 Shaka-kala

We have already seen that the approximate value of *adhimasa* in one solar month is $\frac{900}{29282}$ and if we adopt the same denominator for the fraction $\frac{1170144}{51840000}$ the numerator (say N) can be found out in the following way —

$$\frac{N}{29282} = \frac{117044}{51840000}$$

$$\text{or} \qquad N = \frac{29282 \times 117044}{51840000} = 660 \frac{49756608}{51840000}$$

The fraction being equal to more than half can be taken as one, so that

$$D = 661, \text{ and the fraction } = \frac{661}{29282}$$

Hence if the number of solar months that elapsed since the beginning of 888 Shaka-kala is "S", then the number of *adhimasas* that accumulated during "S" solar months is given by the expression $\frac{900 \times S + 661}{29282}$

We have seen that in a Chaturyuga the total number of synodic lunar months is 53433336, so the total number of *tithis* is 53433336 × 30 = 1603000080

But the number of civil days in a Chaturyuga is 1577917828, so the excess synodic lunar days or the unaratra days are 1603000080—1577917828 = 25082252 Therefore, the number of unaratra days in one *tithi* is $\frac{25082252}{1603000080}$ In order to simplify the fraction if we select the numerator by inspection as 3300, the corresponding denominator (say d) can be found out in the following way –

$$\frac{3300}{d} = \frac{25082252}{1603000080}$$

$$\text{or } d = \frac{3300 \times 1603000080}{25082252} = 210902 \frac{2936696}{25082252}$$

The fraction being equal to less than half may be ignored, so that

$$d = 210902 \text{ and the fraction is } \frac{3300}{210902}$$

Now at the beginning of 888 Shaka-kala the total number of solar days that elapsed since the beginning of Kaliyuga is 48804 × 30 = 1464120 the number of *tithis* in 1500 synodic lunar months is 45000, the sum of these two is 1509120 The number of unaratra days during this period is

$$\frac{1509120 \times 2508225}{1603000080} = 23613 \frac{48724920}{1603000080}$$

The complete number of these unaratra days is deducted from 1509120 and the remainder 1485507 is the number of civil days or the ahargana, but the fraction $\frac{48724920}{1603000080}$ remains unaccounted for, which represents the portion of incomplete unaratra day In order to account for this fraction we adopt

thesame d enominator and then the numerator (say n) can be found out as follows —

$$\frac{n}{210902} = \frac{48724920}{1603000080}$$

$$\text{or } n = \frac{210902 \times 48724920}{1603000080} = 64105\ \frac{1510650000}{1603000080}$$

The fraction being equal to more than half can be taken one, so that n = 64106, and the fraction is $\frac{64106}{210902}$

Therefore for "L" synodic lunar days since the beginning of 888 Shaka kala the unaratra days can be found out by the expression $\frac{3300 \times L + 64106}{210902}$

From this expression whatever we get as the quotient is the first fixed number and whatever we get as the remainder, is the second fixed number, the first fixed number represents the complete unaratra days and the second fixed number represents the incomplete unaratra day Both of these fixed numbers will be utilised later on for the computation of the moon's position in the Zodiac

Dr Schram could not find out the actual basis of the above-mentioned expression and so he had erroneously supposed that the method employed was based on the Pulisa's theory in which the number of civil days in a Chaturyuga is 1577917800, but actually it is based on the theory of the modern *Surya Siddhanta*, in which the number of civil days in a Chaturyuga is 1577917828 Due to this misunderstanding, Dr Schram, after giving the detailed calculations in his support, had wrongly concluded that "The fraction of unaratra days $\frac{232}{703}$ is equal to $\frac{69600\ \frac{464}{703}}{210902}$ or nearly to $\frac{69601}{210902}$ Therefore we must add 69601 before dividing by 21092 Al-Bīrūnī has given, instead of this number 69601, the number 64106, 4 instead of 9, and the last three numbers reversed (vide *Alberuni's India*, 1910, vol II page 376, Annotations)

From the above reasoning it is quite clear that the supposition of Dr Schram is totally baseless and the figures given by Bīrūnī are absolutely correct

(d) *Additional examples* —It will be seen that from this method we can find out the *ahargana* only for the period after 888 Shaka-kala But from similar reasoning it is quite possible to evolve an additional method to find out the negative *ahargana* for any date before 888 Shaka-kala Such a negative *ahargana* will be counted backward from the end of 887

Shakakala and separate methods can also be evolved for every planet to compute its position by means of this negative *ahargana* This method of finding the negative *ahargana* along with completely solved examples is given in Appendix 'A' of this English translation

It will not be out of place to give a simple method here for finding out the ahargana of *Karana Tilaka* from the dates of the Christian calendar This method can be employed for any date after 1601 A D (Gregorian)

"Deduct 1601 from the current Christian era and multiply the remaining number by 365 Keep this product at one place Now divide the same remaining number by 4 and add the quotient to the above-mentioned product kept at one place Then divide the above-mentioned quotient by 25 and deduct this second quotient from the above-mentioned product Then divide this second quotient by 4 and add this third quotient to the same above-mentioned product To this sum add the number of days of the current year with effect from 1st January, including the current day Finally, add 231841 to this total number, then you will get the *ahargana* of *Karana Tilaka* which begins with Sunday" Actually 231841 is the *ahargana* of *Karana Tilaka* on 31st December, 1600 A D which was a Sunday In other words if we deduct 2073972 from the Julian Day Number of any date, we get ahargana of *Karana Tilaka*, and vice versa

For example, let us calculate the *ahargana* on 10 May, 1957 A D, when the 100th anniversary of the Freedom Struggle of India was celebrated all over Indo-Pak sub-continent We deducted 1601 from 1957 and got 356 as remainder, we multiplied this remainder by 365 and got the product 129940 We kept this product at one place Then we divided the same remaining years 356 by 4 and got the quotient 89, we added it to the above-mentioned product and got 130029, then we divided 89 by 25 and got 3 as the quotient which was deducted from the above-mentioned product and we got 130026 as remainder When we divided 3 by 4 we got zero as quotient, so we ignored it To this we added 130 days of the current year and got 130156, to this we added 231841 and got the total sum 361997 This is the *ahargana* of *Karana Tilaka* for 10 May, 1957, which is a Friday because after dividing this *ahargana* by 7 we get 6 as remainder, which gives us Friday by counting it from Sunday Now if we require, we add 2073972 to the ahargana and get 2435969 as Julian Day Number

3 SELECTED DATE FOR THE EXAMPLE

To give an example for it we take a famous day, i e, the day of the meeting of Sulṭān Maḥmūd with Khān Yūsuf (may God bestow His mercy on both of them) This meeting took place between the two armies at a valley near Samarqand on Thursday 27 Ṣafar 416 A H (in the manuscript 25 Ṣafar 416 A H), 29 Naisan 1336 Roman, 21 Urdibihisht, 294 Yazdjird, and according to the (Amanta system of) Hindus it was 29th *tithi* of Vaishakha, the second lunar month of 947 Shaka-kala (in the manuscript 27th *tithi* of Jeshtha, the third lunar month of 948 Shaka-kala)

COMMENTARY

(a) *Correction of the Manuscript*

There are two very serious mistakes in the manuscript which appear to be due to some misunderstanding on the part of Bīrūnī He selects an important date as an example and makes all his calculations on the basis of that date That date, as he has himself mentioned, is 29 Naisan 1336 Roman, 21 Urdibihisht, 394 Yazdjird, Thursday This date actually corresponds to 27 Ṣafar, 416 A H (if we reckon the months from the actual visibility of the crescent), and not to 25 Ṣafar, 416 A H , as Bīrūnī has mentioned A method to find out the visibility of the new moon in his *Ghurrat-uz-Zījāt* is given which will be fully explained and exemplified when we reach that chapter According to this method, we can clearly see that the new moon of Ṣafar at Multān (for which place Bīrūnī has made all his calculations in the examples) was sighted on 2 Naisan, 1336 Roman If we convert this date into the Christian calendar, we get 2 April, 1025 A D (Julian) which was a Friday Therefore, on 29 Naisan 1336 Roman (which corresponds to 29 April, 1025 A D) it was 27 Ṣafar, 416 A H If we adopt the "conventional' method of the Muslim calendar (which was used by the Muslim astronomers and was independent of the actual visibility of the new moon) we get 28 Ṣafar instead of 27 Ṣafar But I have preferred to accept 27 Ṣafar, because it depends on the actual visibility of the new moon In any case the date 25 Ṣafar as given by Bīrūnī, is incorrect

Similarly, the date in question corresponds to 29 Vaishakha 947 Shaka-kala (according to the Amanta system of reckoning, which will be explained later), and not 27 Jeshtha, 948 Shaka-kala as given by Bīrūnī Even if we use 'Purnimanta'' system of reckoning (which will be explained later) we find that the date in question corresponds to 14 Jeshtha and not to 27 Jeshtha Perhaps Bīrūnī was confused in understanding the complicated calculations of "Amanta" and "Purnimanta" systems I have seen that even the Hindu astronomers are often confused in these two systems, especially while making calculations for *'adhimasa*'' or the intercalary month The mistake of writing 948 Shaka-kala instead of 947 Shaka-kala, is obviously due to the fact that under this system, unlike all other calendars, the number of the total years passed is used, instead of the number of the current year For example, when we write 29 Naisan 1336 Roman, we mean that 1335 complete years of the Roman era have passed and the 1336th year is now passing But when we write 29 Vaishakha 947 Shaka-kala, we mean that 947 complete years of Shaka-kala have passed and the 948th year is now passing Here Bīrūnī has used the figure 948 in the usual sense that 948th year of Shaka-kala is passing which should have not been used Therefore, I have corrected this figure in the text accordingly and have written 947 Shaka-kala, instead of 948 Shaka-kala

I wonder how could Bīrūnī make this mistake here, although in his *Indica* he has clearly stated that the year of the Hijra 416 corresponds to 947 Shaka-kala (vide *Al-Beruni's India* 1910 vol II, p 9, l 19)

(b) *Translation of Technical Terms*

(i) *AMANTA AND PURNIMANTA SYSTEMS* —A brief description of these two systems has already been given earlier in this article Here a more detailed description is given in order to show how complicated calculations are involved in finding out a date It has already been explained that from the time of conjunction of the Sun and the Moon up to the time of their opposition, the period is known as the "bright half" or "Shukla Paksha" of the lunar month, and from conjunction to opposition it is the "dark half" or "Krishna Paksha" The following concrete example will show how these "halves" or "Pakshas" are combined in "Amanta" and "Purnimanta" systems and how an "intercalary" month or "*adhimasa*" is calculated It is also shown in which "Paksha" the transit of the Sun or "Sankranti" has taken place The names of the twelve signs of Zodiac or "Rasis" through which the Sun passes are —(1) Aries (2) Taurus (3) Gemini (4) Cancer (5) Leo (6) Virgo (7) Libra (8) Scorpio (9) Sagittarius (10) Capricorn (11) Aquarius and (12) Pisces Their Sanskrit names are (1) Mekha (2) Brikha (3) Mithuna (4) Karka (5) Singha (6) Kanya (7) Tula (8) Vrishchika (9) Dhanu (10) Makara (11) Kumbha and (12) Meena

Purnimanta			*Amanta*
	Shukla Paksha	(No Sankranti)	Chaitra
Vaishakha	Krishna Paksha	(Mekha Sankranti)	
Adhimasa	Shukla Paksha	(No Sankranti)	Vaishakha Adhimasa
Vaishakha	Krishna Paksha	(No Sankranti)	
	Shukla Paksha	(Brikha Sankranti)	Vaishakha
Jeshtha	Krishna Paksha	(No Sankranti)	
	Shukla Paksha	(Mithuna Sankranti)	Jeshtha
Ashadha	Krishna Paksha	(No Sankranti)	
	Shukla Paksha	(Karka Sankranti)	

From the above example it will be seen that both in the Shukla Paksha and the next Krishna Paksha there was no Sankranti and, therefore this month has been dropped out and is termed as Vaishakha *adhimasa* These two particular Pakshas make one complete month of Amanta system, but they do not make a complete month of the Purnimanta system, because under the Purnimanta system these two Pakshas belong to two different months So for an *adhimasa* it is essential that the two adjacent Pakshas in which no Sankranti occurs, must belong to one complete month of the Amanta system, otherwise,

it will not be termed as an *adhimasa* For example, the following case may be examined —

Purnimanta	Paksha	Sankranti	*Amanta*
	Shukla Paksha	(Mekha Sankranti)	Chaitra
Vaishakha	Krishna Paksha	(No Sankranti)	Chaitra
Vaishakha	Shukla Paksha	(Brikha Sankranti)	Vaishakha
Jeshtha	Krisnna Paksna	(No Sankranti)	Vaishakha
Jeshtha	Shukla Paksha	(No Sankranti)	Jeshtha
Ashadha	Krishna Paksha	(Mithuna Sankranti)	Jeshtha
Ashadha	Shukla Paksha	(No Sankranti)	Ashadha
	Krishna Paksha	(Karka Sankranti)	Ashadha

It should be carefully seen that, although there are two adjacent Pakshas in which no Sankranti occurs, yet there is no *adhimasa*, because these two Pakshas do not make a complete month of the Amanta system, one Paksha belongs to Vaishakha and the other Paksha belongs to Jeshtha No doubt these two Pakshas make a complete month of Jeshtha according to the Purnimanta system, but, for the calculation of *adhimasa*, we always consider the Amanta system

Now turning to the actual figures of the text, we find that the date in question was 29 Vaishakha, i e , 14 of Krishna Paksha (15 *tithis* being reckoned in Shukla Paksha), and we may call this date as Vaishakha Krishna Paksha Chaturdashi (Amanta) The same date according to the Purnimanta system is 14 Jeshtha, i e 14 of Krishna Paksha, and we may call the same date as Jeshtha Krishna Paksha Chaturdashi (Purnimanta) In northern India the Purnimanta system is used in performance of all religious ceremonies, except in determination of *adhimasa*, in which case the Amanta system is used In astronomical calculations the Amanta system is considered easier and perhaps for this reason Bīrūnī has used this system in his text But it appears that he had not thoroughly studied these two systems, as is evident from his *Indica* also

(ii) *ḤIJRA CALENDAR* —This calendar is used by all the Muslims of the world for religious performances The commencement of the month is taken after the actual visibility of the new moon The day is reckoned from evening to evening Each month has either 29 days or 30 days Generally, these two types of months occur alternately, but it is also possible that in extreme cases there are three consecutive months of 29 days each, or four consecutive months of 30 days each There are various astronomical methods to find out whether the new moon will be visible at a particular place on a particular day or not, but these methods are so complicated that it is very difficult to prepare a calendar on the basis of the actual sightibility of the new moon

Therefore, the Muslim astronomers had devised a "conventional" calendar independent of the actual sightibility of the new moon This calendar gives a date which is usually one or two days ahead of the actual date determined by the visibility of the new moon For this conventional method the astronomers have decided to reckon the days of the month in the following way —

1	Moḥarram	30	2	Ṣafar	29
3	Rabī' I	30	4	Rabī' II	29
5	Jamādī I	30	6	Jamādī II	29
7	Rajab	30	8	Sh'abān	29
9	Ramzān	30	10	Shawwāl	29
11	Dhū al-Qaḍa	30	12	Dhū al-Ḥijjah	29

In this way there are only 354 days in a year, but during a period of 30 years there are eleven leap years, in which the twelfth month has 30 days, instead of 29 days These leap years are 2nd, 5th, 7th, 10th, 13th, 15th, 18th, 21st, 24th, 26th and 29th years from the beginning of each period of 30 years The complete years of the Hijra era may be divided by 30, and for the remainder the above-mentioned order may be considered to find out the leap year In this way the total number of days which elapsed since the beginning of the Ḥijra era up to 28 Ṣafar 416 A H comes to 147120 The first day of the Ḥijra era was a Thursday, therefore 147120th day of this era was also a Thursday (this can be verified by dividing the total number of days by 7 and counting the remainder from Thursday) Apart from this conventional method, we have seen that the actual date of the Hijra era was 27 Ṣafar, which shows that there was a difference of one day between these two systems

(iii) *ROMAN CALENDAR* —In this calendar, one year is supposed to be of 365¼ days and for this reason three consecutive years are supposed to have 365 days each and the fourth year is supposed to be a leap year of 366 days There are twelve months in a year and each month has a fixed number of days except the fifth month which has twenty-eight days in ordinary years and twenty-nine days in leap years The names of the months and the days in each month are given below —

1	Tashrin I	31	2	Tashrin II	30
3	Kanun I	31	4	Kanun II	31
5	Shubat	28	6	Azar	31
7	Naisan	30	8	Ayar	31
9	Haziran	30	10	Tamoz	31
11	Ab	31	12	Elol	30

It will be seen that the number of days in each month is the same as in the Christian calendar in which February corresponds to Shubat The difference between the Roman calendar and the Christian calendar is that in the Roman calendar the year begins with the month Tashrin I (which corresponds to October), but in the Christian calendar the year begins with January, (which corresponds to Kanun II) Moreover, the Roman era starts 311 years earlier than the Christian era, so that if we deduct 311 years from the Roman era, we get the Christian era In this way 29 Naisan 1336 Roman corresponds to 29 April, 1025 A D The total number of days of the Roman era which elapsed since its beginning up to 29 Naisan 1336 Roman is 487820 The first day of this era was Monday, therefore 487820th day of this era was Thursday (this can be verified by dividing the number of days by 7 and counting the remainder from Monday) To find out whether a particular year is a leap year or not, we should add 1 to the current year of the Roman era and then if it is divisible by 4, it is a leap year So the year 1336th was not a leap year but its preceding year was a leap year

(iv) *YAZDJIRD CALENDAR* —In this calendar each year is supposed to be of 365 days without any fraction, so that there is no leap year in this system There are twelve months in a year and each month has 30 days, each of which has a separate name The remaining 5 days are added either at the end of the eighth month or at the end of the twelfth month, these five days also have separate names The names of the months are given below —

Farwardinmah, Urdibihishtmah, Khurdadmah, Tirmah, Murdadmah, Shahrewarmah, Mehrmah Abanmah Azurmah Dimah, Behmanmah, Isfindarmuzmah

Similarly, the names of days of each month are given below —

(1) Hurmuz	(2) Behman	(3) Urdibihisht
(4) Shahrewar	(5) Isfindarmuz	(6) Khurdad
(7) Murdad	(8) Debazur	(9) Azur
(10) Aban	(11) Khur	(12) Mah
(13) Tir	(14) Josh	(15) Debimehr
(16) Mehr	(17) Sarosh	(18) Rishn
(19) Farwardin	(20) Behram	(21) Ram
(22) Bad	(23) Debidin	(24) Din
(25) Erad	(26) Ashtad	(27) Asman
(28) Zamiad	(29) Marisfind	(30) Aneran

The names of the remaining five days are different in different books, but the common names are —

(1) Ahnud (2) Ashtud (3) Isfindmad

(4) Hasht (5) Hashtosh

The total number of days of this era which elapsed since the beginning up to Ram (i e, 21st) of Urdibihishtmah 394 Yazdjird, is 143496 The first day of this era was Tuesday, therefore 143496th day of this era was Thursday (this can be verified by dividing the total number by 7 and counting the remainder from Tuesday)

(v) *SHAKA-KALA* —In this calendar very complicated calculations are involved and a luni-solar system is used as already explained in the previous article Each year consists of either twelve or thirteen synodic lunar months In 4320000 years there are 1577917828 civil days and 1603000080 synodic lunar days The total number of days which elapsed since the beginning of this era upto 29 Vaishakha 947 Shaka-kala (Amanta) is 345950 The first day of the era was a Tuesday, therefore the 345950th day of this era was a Thursday (this can be verified by dividing the total number by 7 and counting the remainder from Tuesday)

(c) *Elaboration of the Principle* —

No elaboration of any principle is required

(d) *Explanation of the Text* —

No explanation of the text is required

(e) *Additional Example* —

No additional example is required

4 EXAMPLE FOR THE SELECTED DATE.

(Actually this example is given for 27 Jeshtha 947 Shaka-kala (Amanta) which corresponds to 26 Rabī'-ul-Awwal 416 A H 27 Ayar 1336 Roman, Farwardin 19 Khurdadmah 394 Yazdjird, Thursday)

We took complete years of Shaka-kala 947 and subtracted from it 888, getting the remainder 59 We multiplied it by 12 and to the product added the past two months and then placed the sum at two places above and below We multiplied the lower figure by 900 getting product 639000, to it added 661, getting 639661 We then divided it by 29282 and got the quotient 21 which is the number of *adhimasas*, and the remainder was 24739 Then we added

these *adhimasas* to the figure already written at the upper place getting the sum 731 We multiplied it by 30, getting the product 21930, to it we added the past *tithis* of the third month, i e, 27, getting the sum 21957 We wrote that figure at two places, above and below Then we multiplied the figure at the lower place by 3300, getting the product 7245800, to it we added 64106, getting the sum 2522206 We divided it by 210902, getting the quotient 343 which may be called the first "fixed number" The remainder is 182820 which may be called the second "fixed number" We deducted the first "fixed number" from the figure already written at the upper place, getting the remainder 21614, which is the "*ahargana*"

Although we had said that we would not add anything to this book from our side except the examples, yet we feel the necessity of adding the description as how to find out the dates used in our country from the *ahargana* described by the author of this book, because it is evident that non-Hindus do not know the dates used by the Hindus

COMMENTARY

(a) *Correction of the Manuscript* —

There is no correction required in this article As explained in the previous article, Bīrūnī has made a mistake in calculating the luni-solar date of the Hindus He has selected a date to quote as an example and that date is 29 Naisan, 1336 Roman, which actually corresponds to 29 Vaishakha 947 Shaka-kala (Amanta) or 14 Jeshtha 947 Shaka-kala (Purnimanta) In more technical words these dates may be called as Vaishakh Krishna-Paksha Chaturdashi (Amanta) or Jeshtha Krishna Paksha Chaturdashi (Purnimanta) Whatever system, whether Amanta or Purnimanta, is used, we have to reckon the past *tithis* from Chaitra Shukla Pratipada which is common to both systems and the same result is obtained So we see that according to these dates full one month and twenty-nine *tithis* had passed since Chaitra Shukla Pratipada But Bīrūnī has erroneously supposed that it was 27 Jeshtha (Amanta) and according to this he supposed that full two months and 27 *tithis* had passed since Chaitra Shukla Pratipada Therefore, he wrongly calculates the *ahargana* for 29 Naisan 1336 Roman as 21614 If we correctly calculate the *ahargana* for 29 Naisan 1336 Roman, which corresponds to 29 Vaishakha 947 Shaka-kala (Amanta), we get 21586, i e, 28 days less than the figure calculated by Bīrūnī Unfortunately, this difference of 28 was divisible by 7 and so Bīrūnī found the same Thursday according to his *ahargana* and consequently thought his *ahargana* to be correct, because if the day of the week tallies with the *ahargana*, the *ahargana* is taken to be correct If we divide the *ahargana* by 7 and count the remainder from Sunday, we get the day of the week It will be seen that both from 21614 and 21586 we get 5 as remainder after dividing by 7, which gives Thursday

At first I thought of making correction in the *ahargana* and changing the figure 21614 to make it 21586 But afterwards I found that if the *ahargana* was changed, the whole calculations of the book would have to be changed, because the entire calculations are based on this *ahargana* Therefore, I have not changed the *ahargana*, but have clearly shown that this *ahargana* is not in accordance with 29 Naisan 1336 Roman, but it actually corresponds to 27-Ayar 1336 Roman, 19 Khurdadmah 394 Yazdjird, 26 Rabī'-ul-Awwal, 416 A H Jeshtha Krishna Paksha Dawadashi (Amanta) or Ashadha Krishna Paksha Dawadashi (Purnimanta) 947 Shaka-kala, Thursday, 27 May 1025 A D (Julian) This fact should also be borne in mind that 26 Rabī'-ul-Awwal has been calculated according to the actual sightibility of the new moon According to the "conventional" system, as explained in the previous article, it is 27 Rabī' ul-Awwal, i e, one day more than the actual date In future we will always use the actual Islamic date according to the visibility of the moon and not according to the "conventional" system

(b) *Translation of the Technical Terms*

No clarification of any kind is required

(c) *Elaboration of the Principle*

No elaboration of any principle is required

(d) *Explanation of the Text*

No explanation is required

(e) *Additional Example*

As an additional example we can calculate the correct *ahargana* on 29 Naisan 1336 Roman which corresponds to 29 Vaishakha (Amanta) 947 Shaka-kala, as shown below

We subtracted 888 from the Shaka-kala 947 and got 59, multiplied it by 12 and to the product added one month already passed, getting 709, placed this figure at two places and multiplied the lower figure by 900, getting 638100, to it added 661 getting 638761, divided it by 29282 and got the quotient 21 which is the number of *adhimasas*, and the remainder was 23839, then added the *adhimasas* to the figure writing 730, multiplied it by 30 getting 21900, to it added the past *tithis* 29, of the second month Vaishakha getting 21929, wrote it at two places and multiplied the lower figure by 3300 getting 72365700, to it added 64106 getting 72429806, then divided it by 210902 getting the quotient 343 as the first fixed number and the remainder 90420 as the second fixed number, now deducted the first fixed number from the figure at the upperp lace and got 21586 which is the required *ahargana* for the given date

5. TO FIND THE DATE OF YAZDJIRD ERA FROM THIS DATE:

When we want to know the date of Yazdjird from this date, we divide the corresponding *ahargana* by 365 and add 334 to the quotient to get the complete years of Yazdjird era (and the next year is the current year) From the remainder we go on deducting 30 for each month beginning from Farwardinmah For Abanmah we deduct 35, instead of 30, and in this way we come to the month whose days cannot be deducted, then that month is the current month and the remaining days are the days, passed (up to the midnight which immediately follows that day)

Example —We divided the *ahargana* already calculated by 365, getting the quotient 59, we added 334 to it, getting the sum 393 which represents the complete years of Yazdjird era (and the next year, i e , 394th is the current year) After division the remainder was 79, from it we deducted 30 days of Farwardinmah and 30 days of Urdibihishtmah, getting the remainder 19 Therefore, these are the past days of Khurdadmah (up to the midnight which immediately follows that day)

COMMENTARY

(a) *Correction of the Manuscript*

In this article also Bīrūnī had made a mistake by stating that "deduct 29 from the *ahargana* and then divide the remainder by 365" I have deleted this phrase from the text, because Biruni had said so due to the wrong *ahargana* calculated by him He had tried to get the correct result from wrong *ahargana* and therefore, he had made this mistake, otherwise there is no necessity of deducting 29 from the *ahargana* Accidentally the first day of the *ahargana* of *Karana Tilaka* exactly corresponds to the first day of the 335th year of Yazdjird era Therefore we can use the *ahargana* of *Karana Tilaka* without subtracting any thing from it As each year of Yazdjird era consists of 365 days, it is very easy to find out the number of the years passed by dividing the *ahargana* by 365, and after further adding 334 years already passed at the beginning of the *ahargana*, we get the complete years of the Yazdjird era

(b) *Translation of the Technical Terms*

No clarification is required

(c) *Elaboration of the Principle*

On the first day of Yazdjird era, i e , on 1 Farwardinmah, 1 Yazdjird, it was Tuesday, 16 June 632 A D and the Julian day number was 1952063 If we divide the Julian day number by 7 and count the number from Tuesday we get the day of the week, because the first Julian day number was a Tuesday The Julian day number actually is counted from midday to midday at Greenwich but the days of the week are counted from midnight to midnight Therefore there is always a confusion in the relation of the Julian

day number and the day of the week. Ordinarily, if we take the Julian day number before the noon at Greenwich, the first day of this period corresponds to Tuesday, but if we take the Julian day number after the noon at Greenwich, the first day of this period corresponds to Monday I have adopted such Julian day number for all of my references which begins from Tuesday This Julian day number was derived by Joseph Scaliger, and named by him after his father whose name was Julius Scaliger He derived a cycle of 7980 years as the common multiple of the three cycles used by the Roman, this multiple being computed to date from noon of the first of January 4713 B C and to finish by the end of 3267 A D If we need more accuracy of time, we can use decimal fractions also to show the exact moment of a happening For example, the mean noon at Lanka (its longitude being 75° 45′E) when the *ahargana* of *Karana Tilaka* was "1", can be represented by 2073972 78958 Julian day number, but for ordinary use we only say that it was 2073973 Julian day number, and when the *ahargana* of *Karana Tilaka* was 0, the Julian day number was 2073972 It means that if we convert any date into the Julian day number and then subtract from it 2073972, we get the *ahargana* of *Karana Tilaka*, or if we add 2073972 to the *ahargana* of *Karana Tilaka*, we get the Julian day number

Actually the Yazdjird calendar is neither a solar calendar nor a lunar calendar This calendar is mostly used now by the Zoroastrians of Persia for their religious ceremonies It was started from the date of the coronation of the Persian King Yazdjird, son of Shahryar In order to make it a pure solar calendar, the Persian King Jalāl-ud-Dīn Malikshāh, son of Alparsalan Saljūqī ordered the famous poet and astronomer Umar Khayyām to reform it, and since then the majority of the Persians are using the reformed calendar which is known as the "Malikī" or "Jalālī" calendar The Parsis of India and Pakistan still use the same old Yazdjird calendar for their religious performances, but their calendar is known as "Parsi calendar" and is exactly 30 days behind the actual Yazdjird calendar used in Persia The reason for this "lag" is said to be the unaccounted period of one month lost in the migration of the Parsis from Persia to India The actual reason is not known to me This lagging calendar is now known as Shahinshahi while the old Yazdjird Calendar is known as Kadami

(d) *Explanation of the Text* —

The correction made by me in the actual method of the text has already been explained Due to this correction the figures of the calculation given in the "Example" have also been changed I am giving here these changes as well as the original figures of the manuscript

(i) The following phrase has been deleted from the text after the word

من هذا التاريخ

نقصنا من الاصل على ايام التاريخ ۷۹ ابدا

(ii) The following phrase has been deleted from the examples in the beginning —

اذا نقصنا من الاصل الذى عملناه ٩ ٢ فبقى ٢١٥٨٥ قسمناه على ٣٦٥

and instead of the above phrase, the following phrase has been added.

اذا قسمنا الاصل على ٣٦٥

(iii) The figure 50 has been deleted from the example and in its place 79 has been written

(iv) The following phrase has been deleted from the example

وبقى معنا ٢٠ فهى الايام الماضية من ارد يبهشت ماه

and in its place the following phrase has been inserted —

وبقى معنا ٧٩ والقينا منه لاردبيهشت ماه ل وبقى ٤٩ فهى الايام
الماضية من خرداد ماه (بنصف الليل الذى بعد النهار المحسوب له)

(c) *Additional Example*

No additional example is required

6 TO FIND THE DATE OF HIJRA ERA FROM THIS DATE

When we need to find the Arabic date from the date of the Hindus given in this book, we add 87 in the *ahargana* and multiply the sum by 60 (and divide this product by 911704, and deduct, the quotient from the same product) Whatever we get, we divide it by 21262 and add 354 to the quotient, getting the complete years of the Hijra era (and the next year is the current year) Then we divide the remainder which represents ghatis by 60 and the quotient represents complete days, if the remainder is 30 or more, then we further add 1 to the quotient otherwise we ignore it Now we start deducting alternately 30 and 29 from the complete days to get complete months beginning from Moharram, till we get such a remainder from which the days of the next month cannot be deducted This remainder represents the past days of that month (for the coming midnight of the day in question)

Example —We added 87 to the *ahargana* getting the sum 21701, we multiplied it by 60 getting the product 1302060 (we divided this product by 911704 and deducted the quotient from that product getting 1302059), we divided it by 21262 getting the quotient 61 which we added to 354 getting the sum 415 which represents the complete years of the Hijra era (and the next, i e, the 416th year is the current year) From the remaining ghatis we got 85 days, from these days we took 30 days for Moharram, 29 days for Safar and the remaining 26 days belonged to the next month (i e, to Rabī'-ul-Awwal) which had passed (up to the coming midnight of the day in question)

COMMENTARY

(a) *Correction of the Manuscript*

Here also Bīrūnī makes a mistake when he says "we add 57 to the *ahargana*" I have corrected this figure and have written 87 instead of 57 This mistake also is due to the wrong *ahargana* calculated by Bīrūnī, he had made a mistake in calculating the *ahargana* and then he had tried to get the correct date of the Hijra era from that wrong *ahargana* Moreover, he had supposed that 29 Naisan 1336 Roman corresponded to 25 Ṣafar 416 A H, but actually it was 27 Ṣafar 416 A H, so a mistake of 2 days was made in supposing a wrong date Similarly, he had calculated the *ahargana* for that date as 21614, but the correct *ahargana* was 21586, so a mistake of 28 days was made in calculating wrong *ahargana* In this way a total mistake of 30 days was made by Bīrūnī in calculating the constant number 57, the correct number should have been $57 + 30 = 87$

Moreover, the method given by Bīrūnī here can hold good only within a span of a few centuries, if we use this method today, i e, after a thousand years, there may occur a mistake of one or two days in the Arabic date So in order to make this method useful for a span of millions of years, I have added a phrase in the original text within a bracket, stating "and divide this product by 911704 and deduct the quotient from the same product" This is just an additional phrase and has no effect on the original text given by Bīrūnī Actually Bīrūnī had no intention to give a method which might be useful for millions and millions of years, because such a long period of time is outside the scope of a "Zīj" or "Karana", which normally covers a period of a few centuries and "simplicity of calculation" is its essence

(b) *Translation of the Technical Terms*

GHATI —In Hindu calculations a day (from sunrise to sunrise) is divided into sixty equal parts and each of this part is called a "ghati" This ghati is further subdivided into sixty parts, each part being called a "pala", each pala is subdivided into sixty parts, each part being called a "vipala" There are further subdivisions of time but usually we calculate up to "vipala" only

(c) *Elaboration of the Principle*

The basic principle of this method is that the number of civil days is converted into the number of synodic lunar days The civil days are first converted into ghatis by multiplying them by 60 Then these ghatis are divided by the figure 21262 which represents the total number of ghatis in a synodic lunar month This figure is obtained from the same elementary constants which were used in formulating the method for *ahargana* It has already been shown that in a Chaturyuga the number of synodic lunar months

is 53433336 and the number of civil days is 1577917828. When these civil days are converted into ghatis by multiplying them by 60, we get 9467506980 ghatis Therefore, the number of ghatis in a synodic lunar year is obtained by dividing these ghatis by the number of synodic lunar years. The synodic lunar years are obtained by dividing the number of months by 12 and getting the quotient 4452778 So the number of ghatis in a lunar year

$$= \frac{94675069680}{4452778}$$

$$= 21262 \frac{103844}{4452778}$$

The fraction being less than half is to be ignored So the approximate number of ghatis in a lunar year is found to be 21262 and this is the figure by which we divide the total ghatis in order to get the complete years of Hijra era

Now if we do not want to ignore the above-mentioned fraction, we account for it in the following way —

In 21262 ghatis the difference $= \frac{103844}{4452778}$

So in 1 ghati the difference $= \frac{103844}{4452778 \times 21262}$

$$= \frac{103844}{94674965836}$$

$$= \frac{1}{911703 \frac{79504}{103844}}$$

The fraction being more than half can be taken as 1 so that we get

$$= \frac{1}{911704}$$

Therefore it is clear that for more accurate results we should divide the total ghatis by 911704 and the quotient should be deducted from the total ghatis, then the remainder will represent a much more accurate figure of the total ghatis This is the correction which I have mentioned in my additional phrase given in the text within a bracket

It can be shown with the help of back calculation that, when the *ahargana* of *Karana Tilaka* was zero, it was 28th of Rabī'-ul-Awwal, 355 A H

It reveals that at the beginning of the *ahargana* of *Karana Tilaka* 354 complete years and 87 complete days of the Hijra era had already passed That is the reason why Bīrūnī tells us to add 87 days in the *ahargana* of *Karana Tilaka*, so that we may get the complete days that have elapsed since the beginning of the 355th year of the Hijra era After converting these civil days into synodic lunar days, months and years, he further tells us to add 354 to the number of the lunar years obtained from the *ahargana*, this is due to the fact that 354 of the Hijra era had already passed at the beginning of the *ahargana* of *Karana Tilaka*

(d) *Explanation of the Text* —

As already mentioned, Bīrūnī had made a mistake in the calculation of the *ahargana* for 29 Naisan 1336 Roman and from that wrong *ahargana* he had tried to derive correct date of the Hijra calendar For this reason the method given by him was wrong which has now been corrected Consequently, the calculations of the example have also gone wrong The changes made by me in the original text are shown below –

(i) I have deleted the following phrase from the text

ردنا على الأصل بر

and in its place the following phrase has been inserted

ردنا على الأصل فر

(ii) I have added the following phrase in the text within brackets for greater accuracy

(وقسمنا المجتمع على ٩١١٤٠٣ والقينا ما خرج من المجتمع)

(iii) I have added the following phrase in the text within brackets to give better understanding

(بنصف الليل الذى بعد النهار المحسوب له)

(iv) I have added the following phrase in the example within brackets (for greater accuracy)

(قسمناه على ٩١١٤٠٣ و القينا منه ما خرج فبقى ١٣٠٢٠٥٩)

(v) I have deleted the following phrase from the example

للمحرم ل و بقى كه و هى الأيام الماضيه

and in its place the following phrase has been inserted

للمحرم ل وللصفر كط و يبقى كو و هى الأيام الماضيه من
ربيع الأول (بنصف الليل الذى بعد النهار المحسوب له)

(vi) The following further changes have been made in the figures of the example

I have written طز instead of نز, 21701 instead of 21671, 1302060 instead of 1300260 طه instead of ه and 85 instead of 55

(e) *Additional Example*

No additional example is required

7 TO FIND THE DATE OF ROMAN ERA FROM THIS DATE·

When we intend to find the date of the Roman era, we add 175 to the *ahargana* and multiply the sum by 60, to the product we add 30 and then divide it by 21915, to the quotient we add 1276 getting the complete years of the Roman era (and the next year is the current year) The remainder represents the ghatis which are converted into days, then we start subtracting the date of the month beginning from Tashrin I, as we have done in all other dates If it is a leap year, we take 29 days for Shubat, and if it is not a leap year we take 28 days The indication for a leap year is that while converting the ghatis into days, we get complete days and no remainder is obtained

Example —We added 175 to the *ahargana* getting 21789, we multiplied it by 60 and got 1307370, to it we added 30 and got 1307370, we divided it by 21915 and got the quotient 59, to it we added 1276 and got the sum 1335 which represents the complete years of the Roman era (and the next, i e the 1336th year is the current year) The remainder was 14385 ghatis which while converted into days, gave 239 As we get some remainder also while converting ghatis into days, it is not a leap year From it we deducted the number of days of seven months beginning from Tashrin I, i e, 212, and got the remainder 27 This is the number of days of Ayar already passed (up to the coming midnight of the day in question)

COMMENTARY

(a) *Correction of the manuscript* –

There are two main corrections made by me in this article As already explained, Bīrūnī had calculated a wrong *ahargana* and from this wrong *ahargana* he had tried to get the correct date of the Roman era For this purpose he had said, "we add 147 to the *ahargana* ", but due to the mistake of 28 days made by Bīrūnī in *ahargana*, this figure should have been $147 + 28 = 175$ Therefore I have deleted the figure 147 in the text and have written 175 in its place Due to this correction, most of the figures of the example have also been changed which will be explained later

The second mistake made by Bīrūnī is that he has not taken into account the 30 ghatis already accumulated for the previous two years, without adding these 30 ghatis into the total ghatis of the *ahargana* we cannot find out correct leap years So I have added a phrase to the text stating, "to the product we add 30" in order to eliminate the mistake made by Bīrūnī All such petty mistakes clearly show that Bīrūnī wrote this book in a hurry and had never a chance to see it again These mistakes are never a proof of Bīrūnī's lack of knowledge

(b) *Translation of the Technical Term* —

We have already described the names of the months of the Roman era and no further clarification is required

(c) *Elaboration of the Principle* -

Bīrūnī has based this method on the fact that every fourth year of the Roman era is a leap year and consists of 366 days, instead of 365 days Therefore the mean duration of a year in this system is 365¼ days or 21915 ghatis Therefore, if we convert the *ahargana* into ghatis by multiplying it by 60 and then divide the total number of ghatis by 21915, we get the complete years of the Roman era The difference of 15 ghatis per year becomes 60 ghatis in the fourth year and that year is considered as a leap year, but it is very important to remember that in the Roman era you cannot find out the leap year simply by dividing the current year by 4 as we do in the case of the Christian era In the Roman era you should add 1 to the current year and then divide by 4 to find out the leap year In the leap year of the Roman calendar the fifth month Shubat has 29 days instead of 28 days

It can be shown by back calculation that when the *ahargana* of *Karana Tilaka* was zero, it was 24th of Azar 1277 Roman It shows that before the start of the *ahargana* of *Karana Tilaka*, 175 days of the 1277th year had already passed from Tashrin 1 to 24 Azar (i e, 31 + 30 + 31 + 31 + 28 + 24 = 175) So if we add 175 to the *ahargana* of *Karana Tilaka*, we get the complete days from the start of the 1277th year, i e, 1276 complete years had already passed That is why we add 1276 to the complete years obtained by the *ahargana* in order to get the complete years of the Roman era Moreover, the 1275th year was a leap year which means that before the start of that year a a difference of 15 ghatis per year had already accumulated to 60 ghatis, or full one day. Therefore, a difference of 15 ghatis was accumulated in the 1275th year and a difference of 15 ghatis was accumulated in the 1276th year, and so a total difference of 30 ghatis had already accumulated before the start of the 1277th year This is why we add 30 ghatis to the total ghatis of the *ahargana* to get the correct number of ghatis since the beginning of the 1277th year of the Roman era

The Roman calendar was started 12 years after the death of Alexander This calendar is seldom used in the modern world, because it is not a pure solar calendar Actually the length of a solar year (i e., a tropical year, if we use a more technical term) is equal to 365 242195 civil days, and not 365.25 civil days, as is assumed in the Roman calendar Therefore a difference of 0 007805 day per year accumulates to 3 122 days in four centuries Therefore if we decide that the first, second and third centuries will not have a leap year but the fourth century will have a leap year, then the above-mentioned difference of three adys can be eliminated, but a difference of 0 122 days per four hundred years will still remain unaccounted for, it may be ignored for smaller spans of time

In very early days the Roman calendar was converted into the Christian calendar by changing the beginning of the year and counting the year from the death of Christ So there was a difference of 311 years between the two calendars and when it was the first year of the Christian calendar, it was 312th year of the Roman calendar The Christian year was started from Kanun II, instead of Tashrin I, and this month was named as January, keeping the number of days of each month the same as the Roman calendar This calendar was known as Julian calendar after Julius Caesar who had taken much interest in it This Julian calendar must not be confused with the "Julian day number" or "Julian day" which is absolutely a different thing The names of the Christian months along with their Roman equivalents and number of days are given below showing also the comparative years --

1582 A D	January	Kanun II	31	1893 Roman
	February	Shubat	28 29	
	March	Azar	31	
	April	Naisan	30	
	May	Ayar	31	
	June	Haziran	30	
	July	Tamoz	31	
	August	Ab	31	
	September	Elol	30	
	October	Tashrin I	31	1894 Roman
	November	Tashrin II	30	
	December	Kanun I	31	

The Julian calendar was not a pure solar calendar, as already explained People started feeling that the dates were going out of step with respect to the season In the year 730 A D Venerable Bede, the medieval English scholar, showed that the deviation was more than three days, Roger Bacon in 1200 A D found an error of 7 or 8 days, soon after 1300 A D Dante emphasised the need for calendar reform In 1474 A D, Pope Sixtus IV invited the scientist Regcomontanus to revise the calendar and bring it into

line with the seasons, but the Pope's death interrupted the plan It was not until 1582 A D that Pope Gregory XIII revised the calendar, dropped the 10 days of accumulated error, and decided on the rule that 5 October 1582 A D (Julian) should be considered 15 October 1582 A D (Gregorian), and that only such centesimal years were to be leap years as were divisible by 400 This shows that the same day was called 5 October and also 15 October, and the dates such as 6, 7, 8, 9, 10, 11, 12, 13, and 14 October 1582 A D do not exist at all The *ahargana* of *Karana Tilaka* was 225189 on that peculiar day, it was a Friday, and 5 Tashrin I, 1894 Roman The year 1582 was a leap year according to the old style, and the year 1584 also was a leap year according to the new style, so there was a difference of only two years between two leap years This is the calendar which is so widely used in the world and is known as the Gregorian calendar It is more nearly satisfactory than the Julian calendar but still not perfectly so, and after a few thousand years another slight revision (such as making only such millenniums into leap years as are divisible by 4000) will be necessary The problem is one that cannot be solved except approximately, since the periods of rotation and revolution of the earth are in no simple ratio

The Julian calendar was promptly adopted throughout the Roman Empire, but the Gregorian calendar was not so fortunate, because it was formulated after the Reformation, and the Pope's decision was not immediately accepted everywhere The Catholic nations adopted it at once, but the Protestant nations fell into line only gradually Germany adopted the Gregorian calendar in 1700 A D , England adopted it in 1751, and by that time the two calendars were out of step by 11 days The year began in England on January 1, instead of March 25, for the first time in 1752 A D , although the change had been made in Scotland in 1600 A D Russia adopted the Gregorian calendar only after the Revolution of 1918, so that many Russians now living were born under the old style, i e , the Julian calendar The Russian Orthodox Church still uses the Julian calendar, that is why the Russian Easter may differ by one or two weeks from the date of Easter in the rest of the Christian world

(d) *Explanation of the Text*

As already explained Birūnī has made two basic mistakes in the article due to which the following changes have been made —

(i) I have deleted the following phrase from the text

ردنا على الأصل ١٣٤

and in its place the following phrase has been inserted

ردنا على الأصل ١٣٥

(ii) I have added the following phrase to the text

وردنا على المجتمع ل

(iii) I have added the following phrase to the example

ورد ما على المجتمع ل لعبار ١٣٠٧٣٤٠

(iv) In the example I have written 175 instead of 147, 21789 instead of 21761, 1307340 instead of 1305660, 14385 instead of 12675, 239 instead of 211 لسبعة instead of لستة 212 instead of 182, كز instead of كط and ايار instead of نيسان

(e) *Additional Exampl.*

In this book methods are given to calculate *ahargana* from any calendar but in the modern world the widely used calendar is the Gregorian calendar which unfortunately was not existing at the time of Bīrūnī But from the same reasoning we have found a method of calculating the *ahargana* of *Karana Tilaka* from the Gregorian calendar With the help of this method we found out the *ahargana* for 10 May 1957 as 361997 We have also shown that the difference between the Julian day number and the *ahargana* of *Karana Tilaka* is 2073972 so the *ahargana* can also be found by deducting 2073972 from the Julian day number if we know it Therefore the best method of finding out the *ahargana* in modern days is to find out the Julian day number first which can be found out with the help of any modern ephemeris and then deducting 2073972 from it For example, the Julian day number on 10 May 1957 A D was 2435969 and when we deducted 2073972 from it, we got 361997 which is the required *ahargana* and exactly tallies with the previous *ahargana* obtained by another method

To calculate the Roman date from this *ahargana*, we added 175 to the *ahargana* getting 362172, multiplied it by 60 getting 21730320, added 30 to it getting 21730350, divided it by 21915 getting the quotient 991, added 1276 to it getting 2267 which represents the complete years of the Roman era and the next, i e, 2268th year is the current year We converted the remainder 12558 ghatis into complete days by dividing it by 60, getting 209 days and 45 ghatis, deducted from it the days of the month beginning from Tashrin 1 up to Ayar, i e, 31 + 30 + 31 + 31 + 28 + 31 = 182 days getting the remainder 27 days which belong to Naisan, which is the next month We have taken 28 days for Shubat, because the 2268th year of the Roman era is not a leap year which is evident from the fact that we get a remainder of 45 ghatis while converting the total ghatis into complete days, had it been a leap year there would have been no remainder So we see that the date was 27 Naisan, 2268 Roman We have also shown that there is a difference of 311 years between the Roman and the Christian calendars, so that if we deduct 311 from 2268 we get 1957 which is the Christian year Similarly, at present there is a difference of 13 days between the Roman and Christian months, the difference of 10 days was created in the year 1582 A D by Pope Gregory XIII and a further difference of 3 days has occurred in the years 1700, 1800 and 1900 A D which were not considered

leap years in Gregorian system Therefore if we add 13 days to the Roman date, we get 10 Ayar which corresponds to 10 May of the Christian calendar Therefore it has been verified that our calculations are correct, because we get the correct date 10 May 1957 A D

To calculate the Arabic date from this *ahargana*, we added 87 to the *ahargana* getting 362084, multiplied it by 60 getting the product 21725040, divided it by 911704 getting the quotient 23, deducted it from the same product getting 21725017, divided it by 21262 getting the quotient 1021 and the remainder 16515, added 354 to the quotient getting 1375 which represents the complete years of Hijra era and the next 1376th year is the current year Then we converted the remaining 16515 ghatis into days by dividing it by 60 getting the quotient 275 which represents the complete days of the 1376th year passed It is very important to remember that in these calculations, when we say "so many complete days passed up to such and such particular date" that particular date is also included in the total of the complete days passed, because we always count up to the coming midnight of the particular date Now from 275 complete days we deducted alternately 30 and 29 days for the months beginning from Moḥarram So we deducted 266 days up to Ramzān and the remaining 9 days belong to Shawwāl Therefore the Arabic date on 10 May, 1957 was 9 Shawwāl 1376 A H This date has been verified by me from my personal diary in which it is written that 'Eid was celebrated all over India and Pakistan on 2nd May, 1957 A D , which was 1 Shawwāl 1376 A H

To calculate the Persian date from this *ahargana*, we divided the *ahargana* by 365 getting the quotient 991 and the remainder 282, added 334 to the quotient getting 1325 which represents the complete years of the Yazdjird calendar and the next, i e , 1326th year is the current year From the remaining 282 days we deducted the days of the months beginning from Farwardinmah, i e , 30 + 30 + 30 + 30 + 30 + 30 + 30 + 35 + 30 = 275 days getting the remainder 7 days which belong to Dimah which is the next month So the Persian date on 10 May, 1957 A D was Murdad, 7 Dimah, 1326 Yazdjird This date has been verified by me from a calendar printed in Persia The Parsis of India and Pakistan do not include the five additional days in Abanmah as we have done in the above-mentioned calculations, they add these five special days at the end of the year after Isfindarmuzmah Moreover, they are exactly 30 days backward from the old Persian Kandami calendar but still they call their calendar "Yazdjird Shahin shahi calendar" because except the two above-mentioned variations, the Parsi calendar is exactly similar to the Yazdjird calendar Therefore, if we want to find out the date of the Parsi calendar from the above-mentioned date, we get Mah, 12 Azurmah 1326 Yazdjird Shahinshahi This date also has been verified by me from a calendar printed in India The reformed form of this calendar, known as Maliki or Jalālī calendar, is absolutely different from it and neither years nor months nor days tally with each other The Jalālī year starts from the day when the sun crosses the first point of Aries, so sometimes there are 365 days and

sometimes 366 days in a year which can only be determined by actual calculations. Therefore we can say that the Jalālī calendar is a pure solar calendar and does not require any modifications or alterations from time to time This calendar was derived, as has already been stated, by the famous poet and astronomer, Umar Khayyām Since space does not permit me to give a detailed description of this calendar, I leave it at this stage

(٣) انتخاب التاريخ :-

و نمثل ذلک بیوم مشهور و لیکن یوم التقاء السلطان محمود مع الخان یوسف رحمهما الله و کان علی ثنية بسمرقند بین العسکرین یوم الخمیس کر من صفر (و فی المخطوطة که من صفر) سنة تیو للهجرة و کط من نیسان سنة غشلو من تاریخ الیونانیین و روز رام کا من اردیبهشت ماه سنة شصد لیزدجرد و هو عند الهند یوم التاسع و العشرین القمری من بیشاک امانت ثانی شهور سنة ٩٣٤ لشق (و فی المخطوطة یوم السابع والعشرین القمری من جیت ثالث شهور سنة ٩٣٨ لشق)

(٤) مثال لاستخراج الاصل من التاريخ شک کال:—

(و هو یوم السابع و العشرین القمری من جیت امانت ثالث شهور سنة ٩٣٤ لشق یوم الخمیس کو من ربیع الاول سنة تیو للهجرة و کر من ایار سنة غشلو من تاریخ الیونانیین و روز فرورد ین یط من خرداد ماه سنة شصد لیزدجرد) او ضعنا شک کال التامة ٩٣٤ و نقصنا منها ٨٨٨ فبقی ٩٥ ضربناها فی ١٢ وزدنا علی ما خرج ما مضی من الشهور و هو ٢ و وضعناها فی موضعین و ضربنا اسفلها فی ٩٠٠ فصار ٦٣٩٠٠٠ زدنا علیه ٦٦١ فکان ٦٣٩٦٦١ قسمناه علی ٢٩٢٨٢ فخرج شهور الکبیسة ٢١ و بقی ٢٣٤٣٩ زدنا شهور الکبیسة علی ما الموضع الاعلی فصار ١٣٤ ضربناه فی ٣٠ فبلغ ٢١٩٣٠ و زدنا علیه الایام القمریة الماضیة من الشهر الثالث و هی ٢٤ فاجتمع ٢١٩٥٤ و صعناه فی مکانین و ضربنا اسفلها فی ٣٣٠٠ فاجتمع ٧٢٣٥٨١٠٠ زدنا علیه ٦٣١٠٦ فصار ٧٢٥٢٢٢٠٦ قسمناه علی ٢١٠٩٠٢ فخرج ٣٤٣ المحفوظ الاول و بقی ١٨٧٨٢٠ - المحفوظ الثانی نقصان المحفوظ الاول مما فی المکان الاعلی فبقی ایام التاريخ ٢١٦١٣ و هی الاصل -

و نحن و ان ضمنا ان لا نزید فی الکتاب عن الامثلة فلا بد ههنا من زیادة استخراج التواریخ المستعملة فی بلادنا من هذ التاریخ الذی جعله صاحب الزیج اصلا لاعماله فان جل اصحابنا لا یهتدون الی تاریخ الهند ٥

(٥) استخراج تاريخ یزدجرد من هذا التاريخ :-

واذا اردنا تاریخ یزدجرد من هذا التاریخ قسمنا الاصل علی ٣٦٥ فما خرج زدنا علیه ٣٣٤ فیجتمع سنو یزدجرد التامة و ما بقی القینا لکل شهر من عند فروردین ماه ٣٠ ولا بان من بین الشهور له الی ان لا یبقی ما عندنا بایام شهر فیکون الماضی من الشهر الذی انتهینا علیه (بنصف اللیل الذی بعد النهار المحسوب له)

مثال :- اذا قسمنا الاصل على ٣٦٥ لخرج نط ردنا عليه ٣٣٣ فبلغ ٣٩٣ و تلك سنو يزدجرد التامة و بقي من القسمة ٩٤ فالقيها منه لفروردين ماه ل و بقي معنا ٣٩ و القينا منه لا ردبهشت ماه ل و بقي ٩١ فهي الايام الماضية من خرداد ماه (بنصف الليل الذى بعد النهار المحسوب له)

(٩) استخراج تاريخ الهجرة من هذا التاريخ :-

و اذا اردنا تاريخ العرب من تاريخ الهند في هذا الزيج ردنا على الاصل لزو ضربنا المبلغ في ستين (و قسمنا المجتمع على ٣٠٤١١٩ و القينا ما خرج من المجتمع وقسمنا المجتمع) على ٢١٢٦٢ فما خرج ردنا عليه ٣٥٢ فجتمع سنو تاريخ الهجرة التامة و ما بقي يرفعه من الدقائق الى صحاح الايام بالقسمة على ٦٠ و متى فضلت الدقائق الباقية عن الرفع على ٣٠ جبرناها الى ايام يوما و ان لم يفضل نلغيها ثم نلقي من هذا الايام لشهر ل و لشهر كط و نبتدى بالمحرم الى ان تمنع القاء شهر منها معا فيكون الباقي ما مضى من الشهر الذى انتهينا اليه (بنصف الليل الذى بعد النهار المحسوب له)

مثال :- انا ردنا على الاصل فر فاجتمع ٢١٧٠١ ضربناه في ستين فبلغ ١٣٢٠٦٠ (قسمناه على ٣٠٤١١٩ و القينا منه ما خرج فبقي ١٣٠٢٠٥٩) قسمنا على ٢١٢٦٢ فخرج ٦١ و ردنا عليه ٣٥٣ فصار ٤١٣ و ذلك سنو تاريخ الهجرة تامة و بقي من الدقائق له يوما فصارت الايام ٨٥ و منها للمحرم ل و للصفر كط و بقي كو و هي الايام الماضية من ربيع الاول (بنصف الليل الذى بعد النهار المحسوب له)

(٤) استخراج تاريخ الاسكندر من هذا التاريخ :-

اذا اردنا تاريخ الاسكندر ردنا على الاصل ٥٤١ و ضربنا ما بلغ في ستين و زدنا على المجتمع ل و قسمنا المجتمع على ٢١٩١٥ فما خرج ردنا عليه ١٢٤٦ فيجتمع سنو تاريخ الاسكندر تامة و نرفع ما بقي من الدقائق الى الصحاح فيكون اياما و نلقي منها لكل شهر من تشرين الاول عدد ايامه كما فعلنا في سائر التواريخ فان كانت السنة كبيسة جعلنا حصة شباط من الايام كط و ان لم يكن كبيسة جعلنا ها كح و علامة السنة الكبيسة ان تنحصر الدقائق بالرفع فلا يبقى منها شيء .

مثال :- انا ردنا الى الاصل ٥٤١ فصار ٢١٨٩٤ فضربناه في ٦٠ فبلغ ١٣٠٤٣٣٠ و زدنا على المجتمع ل فصار ١٣٠٤٣٦٠ قسمناه على ٢١٩١٥ فخرج نط و ردنا عليه ١٢٤٦ فاجتمع ١٣٣٥ و هو سنو تاريخ الاسكندر تامة و بقي من الدقائق ١٣٣٨٥ و يكون مرفوعه ٢٣٩ و السنة لا جل الدقائق القاصرة عن الارتفاع غير كبيسة فالقينا لسبعة اشهر منها من عند تشرين الاول ٢١٢ و بقي كز و هي الايام الماضية من ايار (بنصف الليل الذى بعد النهار المحسوب له)

و ما لم يتقرر عكس ما ذكرناه لم يشترك اصحابنا و الهند في استعمال هذا الزيج :-

CHAPTER—IV

RELATING TO THE MEAN PLACES OF THE PLANETS

1 TO FIND THE MEAN PLACE OF MARS

Add $218\frac{1}{2}$ to the *ahargana* and divide the sum by 687, then the quotient will represent the number of revolutions which we do not require, from the remainder find out signs, etc, according to the method already described and keep the result in memory Now consider the *ahargana* again and divide it by 8719, then the quotient will be minutes and will be added to the result kept in memory, deduct $2\frac{1}{2}$ minutes from this sum, then the remainder will be the mean place of Mars (for the midnight which follows the day in question)

Example —We added $218\frac{1}{2}$ to the *ahargana* getting $21832\frac{1}{2}$, divided it by 687 getting the quotient 31 revolutions which were ignored, from the remainder we obtained $9^S\ 10°\ 36'\ 41''$ which we kept in memory Now we divided the *ahargana* by 8719 getting the quotient 2 min 29 sec, which we added to the result already kept in memory getting $9^S\ 10°\ 39'\ 10''$, from it we deducted $2\frac{1}{2}$ min getting the remainder $9^S\ 10°\ 36'\ 40''$ which is the mean place of Mars (for the midnight which follows the day in question)

COMMENTARY

(a) *Correction of the Manuscript*

In this article only one minor correction is made and that is that I have written 8719 instead of 8718, this error of the manuscript seems to be due to the mistake of the original Sanskrit scribe

(b) *Translation of Technical Term*

It has already been explained in the past

(c) *Elaboration of the Principle*

The formula for calculating the mean place of Mars as given in this article is shown below where "A" stand for *ahargana* —

$$\frac{A + 218\frac{1}{2}}{687}\ \text{rev} + \frac{A}{8719}\ \text{min} - 2\frac{1}{2}\ \text{min}$$

The general form of this formula is given below, where X, Y, Z and D are constants —

$$\frac{A + Z}{X}\ \text{rev} + \frac{A}{Y}\ \text{min} - D\ \text{min}.$$

If we ignore the kshepakas Z and D, and put A equal to 1577917828, we get the revolutions in a Chaturyuga or a Mahayuga, now we will see how this formula has been derived by the author of *Karana Tilaka*

$$\frac{1577917828}{687}\text{ rev} + \frac{1577917828}{8719 \times 21600}\text{ rev}$$

$$= 2296823\ 621\text{ rev} + 8\text{-}379\text{ rev} \qquad 2296832\text{ rev}$$

It shows that the number of revolutions of Mars in a Chaturyuga as adopted in *Karana Tilaka* are exactly in accordance with *Surya Siddhanta* (vide chapter I, sloka 30) Now, the motion of the mean place of Mars in one day is $\frac{2296832}{1577917828}$ rev If we select the numerator of a simplified fraction as 1, we can find out its denominator X in the following way —

$$\frac{1}{X} = \frac{2296832}{1577917828}, \text{ or } X = \frac{1577917828}{2296832} = 686\ \frac{2291076}{2296832}$$

the fraction being equal to more than half can be taken as 1 so that X = 687 In order to compensate for this approximation error we can have another fraction giving the result in minutes and having its numerator 1, then its denominator Y can be found out in the following way —

$$\frac{1}{21600\ Y}\text{ rev} = \frac{2296832}{1577917828}\text{ rev} - \frac{1}{687}\text{ rev} = \frac{5756}{1084029547836}\text{ rev}$$

$$\text{or}\quad Y = \frac{1084029547836}{5756 \times 21600} = 8718\quad \frac{124095036}{124329600},$$

the fraction being more than half can be taken as 1 so that Y = 8719 Birūnī has given 8718 instead of 8719 but I have corrected this figure in the manuscript accordingly

Now to find out the kshepakas Z and D, we calculate the mean place of Mars in the beginning of 888 Shaka-kala as follows —

$$\frac{1485507 \times 2296832}{1577917828}\text{ rev} = 2162\ \frac{501669688}{1577917828}\text{ rev}$$

Ignoring the complete revolutions we have an incomplete revolution in the beginning of 888 Shaka-kala, and in order to incorporate this partial revolution we can find out the kshepaka Z so that,

$$\frac{Z}{687} = \frac{501669688}{1577917828}, \text{ or } Z = \frac{687 \times 501669688}{1577917828} = 218\tfrac{1}{2} - \frac{127969762}{1577917828}.$$

So if we take Z = 218½, we should deduct the following figure from the result in order to compensate for the negative fraction, and call this value D, so that,

$$D = \frac{127969762}{1577917828 \times 687} \text{ rev} = \frac{127969762 \times 21600}{1577917828 \times 687} \text{ min}$$

$$= 2\ \frac{596087763528}{1084029547836} \text{ min} = 2 + \cfrac{1}{1 + \cfrac{1}{1 + 0000}} \text{ min} = 2\tfrac{1}{2} \text{ min app}$$

A more accurate value of D could have been taken as,

$$D = 2 + \cfrac{1}{1 + \cfrac{1}{1 + \frac{1}{4}}} \text{ min} = 2\ \frac{5}{9} \text{ min}$$

but the author has preferred the simpler value, i e , 2½ min, the difference between these two values is app 3 sec which is negligible for all practical purposes In the solved example we have calculated the mean place of Mars as $9^{S}\ 10^{\circ}\ 36'\ 40''$, if we calculate the same directly by the method of *Surya Siddhanta*, we get a bit more accurate value $9^{S}\ 10^{\circ}\ 36'\ 37''$

2 TO FIND THE SHEEGHROCHCHA OF MERCURY.

Multiply the *ahargana* by 9000 and from the product deduct 336262, divide the remainder by 791727, then the quotient will be the revolutions which we do not require, from the remainder find out the signs, etc , and keep the result in memory Now divide the *ahargana* by 10060, then the quotient will be minutes, etc , deduct it from the result kept in memory, then the remainder will be the sheeghrochcha of Mercury (for the midnight which follows the day in question)

Example —We multiplied the *ahargana* by 9000 getting the product 194526000, from it we deducted 336262 getting the remainder 194189738, which we divided by 791727 getting the quotient 245 revolutions which we ignored, from the remainder we obtained $3^{S}\ 8^{\circ}\ 29'\ 56''$, which we kept in memory Now we divided, the *ahargana* by 10060 getting the quotient $2'\ 9''$, which we deducted from the result kept in memory getting the remainder $3^{S}\ 8^{\circ}\ 27'\ 47''$, which is the sheeghrochcha of Mercury (for the midnight which follows the day in question)

COMMENTARY

(a) *Correction of the Manuscript:—*

No correction of the manuscript is required except a slip of the pen of the Arabic scribe which has been corrected by me and I have changed the original figure ١٩٣٥٩٩٠٠٠ to read as ١٩٣٥٢٩٠٠٠ which is the correct figure. In the solved example a missing phrase has been inserted by me within brackets

(b) *Translation of the Technical Terms —*

SHEEGHROCHCHA OF MERCURY —This term can also be written as Budha-sheeghrochcha or simply Budhochcha just like Chandrochcha, but I have preferred to write it as sheeghrochcha of Mercury, Bīrūnī has used the term سرعه عطارد for the original Sanskrit term Budha-sheeghrochcha.

(c) *Elaboration of the Principle.—*

The formula for calculating the sheeghrochcha of Mercury as given in this article is shown below where A stands for *ahargana* —

$$\frac{9000\ A - 336262}{791727}\ \text{rev} - \frac{A}{10060}\ \text{min}$$

The general form of this formula can be taken as follows where X, Y and Z are constants —

$$\frac{9000\ A\text{-}Z}{X}\ \text{rev} - \frac{A}{Y}\ \text{min}$$

Now we will see how this formula has been derived by the author of *Karana Tilaka* If we ignore the kshepaka Z and put A equal to 1577917828, we get the revolutions in a Chaturyuga or Mahayuga,

$$\frac{9000 \times 1577917828}{791727}\ \text{rev} - \frac{1577917828}{10060 \times 21600}\ \text{rev} = 17937060\ \text{rev}$$

This value exactly tallies with the value given in *Surya Siddhanta* (vide, chapter 1, sloka 31)

Now the mean daily motion of the sheeghrochcha of Mercury is $\frac{17937060}{1577917828}$ rev, and if we select a numerator 9000 for a simplified fraction, we can find out its denominator X in the following way,

$$\frac{9000}{X} = \frac{17937060}{1577917828},\ \text{or}\ X = \frac{1577917828 \times 9000}{17937060} = 791727\ \frac{5749380}{17937060}$$

The fraction being less than half is ignored so that we have X = 791727 But to compensate for the above error of approximation we can find out another fraction giving the result in minutes and having its numerator as 1, then its denominator Y can be found out in the following way —

$$\frac{1}{21600\ Y} = \frac{9000}{791727} - \frac{17937060}{1577917828} = \frac{5749380}{1249280148208956}$$

$$\text{Or } Y = \frac{1249280148208956}{5749380 \times 21600} = 10059\ \frac{87058336956}{124186608000}$$

The fraction being more than half is taken as 1, so that Y = 10060 Now to find out the kshepaka Z we calculate the sheeghrochcha of Mercury in the beginning of 888 Shaka-kala as follows —

$$\frac{1485507 \times 17937060}{1577917828}\ \text{rev} = 16886\ \frac{907745812}{1577917828}\ \text{rev} = 16887\ \text{rev}$$

$$- \frac{670172016}{1577917828}\ \text{rev}$$

The negative fraction shows the value of the sheeghrochcha of Mercury in the beginning of 888 Shaka-kala Therefore the value of Z can be found as follows -

$$\frac{Z}{791727} = \frac{670172016}{1577917828},\ \text{or } Z = \frac{791727 \times 670172016}{1577917828}$$

$$= 336261\ \frac{1052950524}{1577917828}$$

The fraction being more than half is taken as 1, so that Z = 336262 (negative) If we want to have a positive value of Z, we can use the figure (791727 – 336262) = 455465, but the author of *Karana Tilaka* has used the negative kshepaka, because it is smaller than the positive one and is easier for calculations In the solved example we have calculated the sheeghrochcha of Mercury as 3^{S} 8°27′ 47″, if we calculate the same directly by the method of *Surya Siddhanta* we get a bit more accurate value 3^{S} 8° 27′ 48″

3 TO FIND THE MEAN PLACE OF JUPITER

Multiply the *ahargana* by 100 and from the product deduct 47898, divide the remainder by 433232, then the quotient will be the complete revolutions which we do not require, from the remainder find out signs, etc , and

keep the result in memory Now, divide the *ahargana* by 22200, then the quotient will be seconds which is to be deducted from the result kept in memory; the remainder will be the mean place of Jupiter (for the midnight which follows the day in question).

Example:—We multiplied the *ahargana* by 100 getting the product 2161400, from it we deducted 47898 getting the remainder 2113502; divided it by 433232 getting the quotient 4 revolutions which were ignored, from the remainder we got $10^s\ 16^\circ\ 14'\ 35''$ which we kept in memory Now we divided the *ahargana* by 22200 getting the quotient $1''$, deducted it from the result kept in memory getting the remainder $10^s\ 16^\circ\ 14'\ 34''$, this is the mean place of Jupiter (for the midnight which follows the day in question)

COMMENTARY

(a) *Correction of the Manuscript* —

I have made one major correction in the text of this article and have changed the figure ٢٢٠۴ to read as ٢٢٢٠٠ which is the correct value, I have also changed the figure ٣۴٨٩۴ to read as ۴٧٨٩٨ which is the correct value Due to these two changes the figures of the solved example have also been changed as shown in the following table The justification of these corrections will be given afterwards

Original in Manuscript	Changed after correction	Original in Manuscript	Changed after correction
نقصانه ۴٧٨٩۴	نقصانه ۴٧٨٩٨	السم الاصل على ٢٢٠۴	السم الاصل على ٢٢٢٠٠
فبقى ٢١١٣٥٠٣	فبقى ٢١١٣٥٠٢	فخرج ها ها ها ى	فخرج ها ها ها ا
مما بقى ى يويد لج	مما بقى ى يويد له	فبقى ى يويد كح	فبقى ى يويد لد

(b) *Translation of the Technical Terms* —

No new terms have been translated in this article

(c) *Elaboration of the Principle* —

The formula for calculating the mean place of Jupiter as given in this article is shown below where A stands for the *ahargana*:—

$$\frac{100\,A - 47898}{433232}\ \text{rev} - \frac{A}{22200}\ \text{sec}$$

The general form of this formula can be taken as follows where X, Y and Z are constants,

$$\frac{100\,A - Z}{X}\ \text{rev} - \frac{A}{Y}\ \text{sec}$$

Now we will see how this formula has been derived by the author of *Karana Tilaka* If we ignore the kshepaka Z and put A equal to 1577917828, we get the revolutions in a Chaturyuga or Mahayuga,

$$\frac{100 \times 1577917828}{433232}\ \text{rev} - \frac{1577917828}{22200 \times 1296000}\ \text{rev} = 364220\ \text{rev}$$

This value exactly tallies with the value given in *Surya Siddhanta* (vide chapter I, sloka 31)

Now the daily motion of the mean place of Jupiter is $\frac{364220}{1577917828}$ rev

and if we select a numerator 100 for a simplified fraction we can find out its denominator X in the following way —

$$\frac{100}{X} = \frac{364220}{1577917828} \quad \text{or } X = \frac{1577917828 \times 100}{364220} = 433232\,\frac{1188}{18211}$$

The fraction being less than half is ignored so that X = 433232 But to compensate for this error of approximation we can find out another fraction giving the result in seconds and having numerator as I then its denominator Y can be found out in the following way -

$$\frac{1}{1296000\,Y} = \frac{100}{433232} - \frac{364220}{1577917828} = \frac{23760}{683604496460096}$$

$$\text{or } Y = \frac{683604496460096}{23760 \times 1296000} = 22200\,\frac{784460096}{30792960000}$$

The fraction being less than half is ignored so that we get Y = 22200 Bīrūnī has given this value as 2207 instead of 22200 which shows that either the Sanskrit manuscript possessed by Bīrūnī was incorrect or Bīrūnī could not decipher it correctly In the Sanskrit script there is a close resemblance between 0 and 7, therefore it is just possible that Bīrūnī might have read the last zero of 22200 as 7 and missed its first digit 2, thus making the figure 2207 If we supposed the figure 2207 to be correct, we get the total number of revolutions of mean place of Jupiter in a Chaturyuga equal to 364219½ app which is absurd, because we should always have "complete" revolutions in a Chaturyuga, moreover, these complete revolutions should also be divisible by 4

Now to find out the kshepaka Z we calculate the mean place of Jupiter in the beginning of 888 Shaka-kala as follows —

$$\frac{1485507 \times 364220}{1577917828} \text{ rev} = 342 \frac{1403462364}{1577917828} \text{ rev} = 343 \text{ rev}$$

$$- \frac{174455464}{1577917828} \text{ rev}$$

The negative fraction shows the value of the mean place of Jupiter in the beginning of 888 Shaka-kala and the corresponding value of Z can be found out as follows —

$$\frac{Z}{433232} = \frac{174455464}{1577917828}, \text{ or } Z = \frac{433232 \times 174455464}{1577917828}$$

$$= 47898 \frac{581454104}{1577917828}$$

The fraction being less than half is ignored so that we have Z = 47898, but Bīrūnī has given this value as 47898 which is incorrect and I have corrected it now, the reason for this mistake is not understood clearly We have just seen that the figure 2207 given by Bīrūnī is wrong, another proof of it is this that if we assume 2207 to be correct, the revolutions in Chaturyuga come to be 364219 5031067, and the corresponding value of Z comes to be 48101, instead of 47898 In the solved example we have calculated the mean place of Jupiter as $10^S\ 16°\ 14'\ 34''$, if we calculate the same directly by the method of *Surya Siddhanta*, we get a bit more accurate value $10^S\ 16°\ 14'\ 33''$

4 TO FIND THE SHEEGHROCHCHA OF VENUS

Multiply the *ahargana* by 600 and to the product add 14862, divide the sum by 134819, then the quotient will be revolutions which we do not require, from the remainder find out signs, etc , and keep the result in memory Now divide the *ahargana* by 9980, then the quotient will be minutes, etc , which is to be deducted from the result kept in memory, the remainder is the mean place of Jupiter (for the midnight which follows the day in question)

Example.—We multiplied the *ahargana* by 600 getting the product 12968400, to it we added 14862 getting 12983262 which we divided by 134819 getting the quotient 96 revolutions which we do not require, from the remainder we got $3^S\ 18°\ 30'\ 49''$ which we kept in memory, then we divided the *ahargana* by 9980 getting the quotient $2'\ 10''$ which we deducted from the result kept in memory getting the remainder $3^S\ 18°\ 28'\ 39''$ which is the sheeghrochcha of Venus (for the midnight which follows the day in question)

COMMENTARY

(a) *Correction of the Manuscript* —

No correction is required in this Article

(b) *Translation of the Technical Terms* —

SHEEGHROCHCHA OF VENUS — This term can also be written as Shukra-sheeghrochcha or simply Shukrochcha just like Chandrochcha, but I have preferred to write it as sheeghrochcha of Venus, Biruni has used the term سرعة الزهرة for the original Sanksrit term Shukra-sheeghrochcha

(c) *Elaboration of the Principle* -

The formula for calculating the sheeghrochcha of Venus as given in this article is shown below where A stands for *ahargana* —

$$\frac{600\ A + 14862}{134819}\ \text{rev} \qquad \frac{A}{9980}\ \text{min}$$

The general form of this formula can be taken as follows where X, Y and Z are constants —

$$\frac{600\ A + Z}{X}\ \text{rev} \qquad \frac{A}{Y}\ \text{min}$$

Now we will see how this formula has been derived by the author of ***Karana Tilaka*** If we ignore the kshepaka Z and put A equal to 1577917828, we get the revolutions in a Chaturyuga or a Mahayuga,

$$\frac{600 \times 1577917828}{134819}\ \text{rev} - \frac{1577917828}{9980 \times 21600}\ \text{rev} = 7022376\ \text{rev}$$

This value exactly tallies with the value given in ***Surya Siddhanta*** (vide Chapter I, sloka 32)

Now the daily mean motion of sheeghrochcha of Venus is $\frac{7022376}{1577917828}$ rev, and if we select a numerator 600 for a simplified fraction, we can find out its denominator X in the following way —

$$\frac{600}{X} = \frac{7022376}{1577917828}\ \text{or}\ X = \frac{1577917828 \times 600}{7022376} = 134819\ \frac{986856}{7022376}$$

The fraction being less than half is ignored so that we have X = 134819 But to compensate for the above error of approximation we can find out another

fraction giving the result in minutes and having its numerator as 1; then its denominator Y can be found out as follows —

$$\frac{1}{21600\ Y} = \frac{600}{134819} - \frac{7022376}{1577917828} = \frac{986856}{212733303663132}$$

$$\text{or } Y = \frac{212733303663132}{986856 \times 21600} = 9979\ \frac{20045544732}{21316089600}$$

The fraction being more than half may be taken as 1, so that Y = 9980 Now to find out the kshepaka Z we calculate the sheeghrochcha of Venus in the beginning of 888 Shaka-kala as follows

$$\frac{1485507 \times 7022376}{1577917828}\ \text{rev} = 6611\ \frac{173943724}{1577917828}\ \text{rev}$$

The fraction shows the value of the sheeghrochcha of Venus in the beginning of 888 Shaka-kala Therefore the value of Z can be found out as follows —

$$\frac{Z}{134819} = \frac{173943724}{1577917828} \text{ or } Z = \frac{134819 \times 173943724}{1577917828}$$

$$= 14861\ \frac{1482084048}{1577917828}$$

The fraction being more than half is taken as 1, so that we have Z = 14862

In the solved example we have calculated the sheeghrochcha of Venus as $3^{s}\ 18^{\circ}\ 28'\ 39''$, if we calculate the same directly by the method of *Surya Siddhanta*, we get a bit more accurate value $3^{s}\ 18^{\circ}\ 28'\ 38''$

5 TO FIND THE MEAN PLACE OF SATURN

Multiply the *ahargana* by 4 and from the product deduct $678\frac{2}{3}$, divide the remainder by 43063, then the quotient will be the revolutions which we do not require, from the remainder find out signs, etc , and keep the result in memory Now divide the *ahargana* by 3876, then the quotient will be seconds, deduct it from the result kept in memory, then the remainder will be the mean place of Saturn (for the midnight which follows the day in question)

Example —We multiplied the *ahargana* by a 4 getting 86456, from it we deducted $678\frac{2}{3}$ getting $85777\frac{1}{3}$, divided it by 43063 getting the quotient 1 revolution which we ignored, from the remainder we got $||^{s}\ 27^{\circ}\ 5'\ 7''$ which were kept in memory Now we divided the *ahargana* by 3876 getting the quotient $6''$ which we deducted from the result kept in memory getting the remainder $||^{s}\ 27^{\circ}\ 5'\ 1''$, which is the mean place of the Saturn (for the midnight which follows the day in question)

COMMENTARY

(a) ***Correction of the Manuscript:—***

In the text of this article only two main corrections are made by me; I have corrected the figure $768\frac{3}{4}$ to read as $678\frac{3}{4}$, and the figure 3879 to read as 3876 This error appears either due to the mistake of the original Sanskrit scribe or due to some misunderstanding on the part of Bīrūnī The figures of the solved example have also been corrected by me as follows —

Original in manuscript	Changed after correction	Original in manuscript	Changed after correction
نقصنا منه ۷۶۸ م	نقصنا منه ۶۷۸م	فيما الاصل على ۳۸۷۹	فيما الاصل على ۳۸۷۶
فبقي ۸۵۹۸۷ ک	فبقي ۸۵۷۷۷ک	فيخرج ها ها ها ، لو	فيخرج ها دا ها و
ومما بقي ما كو يط يج	ومما بقي ما كره ر	فبقي ما كو يط يب	فبقي با كره ا

(b) *Translation of the Technical Terms* --

No new terms have been translated in this article

(c) *Elaboration of the Principle* -

The formula for calculating the mean place of Saturn as given in this article is shown below where A stands for *ahargana*,

$$\frac{4A - 678\frac{3}{4}}{43063}\ \text{rev} \qquad \frac{A}{3879}\ \text{sec}$$

The general form of this formula can be taken as follows where X, Y and Z are constants,

$$\frac{4A - Z}{Y}\ \text{rev} \qquad \frac{A}{Y}\ \text{sec}$$

Now we will see how this formula has been derived by the author of ***Karana Tilaka*** If we ignore the kshepaka Z and put A equal to 1577917828, we get the revolutions in a Chaturyuga or Mahayuga

$$\frac{4 \times 1577917828}{43063}\ \text{rev} - \frac{1577917828}{3879 \times 1296000}\ \text{rev} = 146568\ \text{rev}$$

This value exactly tallies with the value given in ***Surya Siddhanta*** (vide Chapter I, sloka 32)

Now the mean daily motion of the Saturn is $\frac{146568}{1577917828}$ rev and if we

select a numerator 4 for a simplified fraction, we can find out its denominator X in the following way —

$$\frac{4}{X} = \frac{146568}{1577917828}, \text{ or } X = \frac{4 \times 1577917828}{146568} = 43063 \frac{13528}{146568}$$

The fraction being less than half is ignored, so that we have X = 43063 But to compensate for the above error of approximation we can find out another fraction giving the result in seconds and having its numerator as 1, then its denominator Y can be found out in the following way —

$$\frac{1}{1296000\ Y} = \frac{4}{43063} - \frac{146568}{1577917828} = \frac{13528}{67949875427164},$$

$$\text{or } Y = \frac{67949875427164}{1296000 \times 13528} = 3875 \frac{12259427164}{17532288000}$$

The fraction being more than half can be taken as 1, so that we have Y = 3876 Bīrūnī has given this value as 3879 due to some misunderstanding, but now I have corrected this figure to read as 3876

Now to find out the kshepaka Z we calculate the mean place of the Saturn in the beginning of 888 Shaka-kala as follows –

$$\frac{1485507 \times 146568}{1577917828} = 137 \frac{1553047540}{1577917828} = 138 - \frac{24870288}{1577917828}$$

The negative fraction shows the value of the mean place of Saturn in the beginning of 888 Shaka-kala Therefore the value of Z can be found out as follows —

$$\frac{Z}{43063} = \frac{24870288}{1577917828}, \text{ or } Z = \frac{43068 \times 24870288}{1577917828} = 678 \frac{1160924760}{1577917828}$$

The fraction being more than half could have been taken as I, but due to the small denominator 43063, the author of *Karana Tilaka* has taken a more accurate value of this fraction as,

$$\cfrac{1}{1 + \cfrac{1}{2 + \cdots}} = \frac{2}{3}$$

so that we have $Z = 678\frac{2}{3}$, the error due to this approximation is plus 2″ app Bīrūnī has given this value as $768\frac{2}{3}$ which is clearly an error of interchange of two digits 6 and 7

In the solved example we have calculated the mean place of the Saturn as ||^{8} 27° 5′ 1″, if we calculate the same directly by the method of *Surya Siddhanta*, we get a slightly more accurate value ||^{8} 27° 4′ 59″

(*N B*) —The readers will note that the mean places of all the planets (except Chandrochcha and Rahu) as calculated by the method of *Karana Tilaka* are approximately the same as calculated directly by the method of *Surya Siddhanta*, therefore we can definitely say that *Karana Tilaka* is based on *Surya Siddhanta* There is a slight doubt in the case of the Moon, because the kshepaka (i e, 180) given in the original manuscript differs from the correct kshepaka (i e 1/18) calculated in accordance with *Surya Siddhanta*, the difference between these two kshepakas is equal to 37 sec app, as already explained in the commentary of article 2, chapter II Although I have corrected the kshepaka given in the original manuscript, yet there can be a very remote possibility that the author of *Karana Tilaka* might have introduced a very small "beeja" (i e, correction) equal to minus 37 sec based on his personal observations Ganesha Devagya, the author of *Graha Laghava*, has also mentioned a similar "beeja" for the Moon equal to minus 9 min in 1442 Shakakala (vide *Graha Laghava*, chapter I, sloka 16) Such corrections, however, have no bearing on the basic principles of a karana book

In the beginning of the 16th century A D the planetary revolutions in a Chaturyuga were further modified by the author of *Makaranda Sarani*, for example, the revolutions of Chandrochcha and Rahu, according to old *Surya Siddhanta* as well as *Khandakhadyaka*, are 488219 and 232226, respectively, according to modern *Surya Siddhanta*, these are 488203 and 232238, respectively, according to *Karana Tilaka*, these are 488211 and 232234, respectively, and according to *Makaranda Sarani*, these are 488199 and 232242, respectively The following table will give an idea of similar modifications according to five different authorities —

"Revolution in a Chaturyuga"

Planets	Old Surya Siddhaanta and Khandakhadyaka	Modern Surya-Siddhanta and Karana Tilaka	Makaranda Sarani
Sun	4320000	4320000	4320000
Moon	57753336	57753336	57753336
Mars	2296824	2296832	2296832
Sheeghrochcha of Mercury	17937000	17937060	17937044
Jupiter	364220	364220	364212
Sheeghrochcha of Venus	7022388	7022376	7022364
Saturn	146564	146568	146580
Civil days	1577917800	1577917828	1577917828

الباب الرابع

فى استخراج اوساط الكواكب الخمسة

معرفة استخراج وسط المريخ :-

رد على الاصل ٢١٨ و نصف ثم اقسم المبلغ على ٦٨٧ ليخرج ادواره لا يحتاج اليها و استخرج البروج و ما تلاها مما بقى كما تقدم ذكره و احفظها ثم عد الى الاصل فاقسمه على ١٩٨٧٩ ليخرج دقائق يزيدها على ما حفظت ثم انقص من الجملة دقيقتين و نصف فيبقى وسط المريخ (لنصف الليل الذى بعد النهار المحسوب) ○

مثال :- اذا رددنا على الاصل ٢١٨ و نصف فصار ٢١٨٣٢ و نصف و قسمناه على ٦٨٧ فخرجت الا دوار الملغاة ٣١ و مما بقى ط ى لو ما يه حفظنا ها ثم قسمنا الاصل على ١٩٨٧٩ فخرج ها ها ب كط يه رددنا ها على المحفوظ فصار ط ى لط ى يه نقصنا منه دقيقتين و نصف فبقى ط ى لو م يه و ذلك وسط المريخ (لنصف الليل الذى بعد النهار المحسوب) ○

(٢) معرفة استخراج سرعة عطارد :-

اضرب الاصل فى ...٩ و انقص من المبلغ ٣٣٦٢٦٢ و اقسم الباقى على ٩١٢٧٨٤ يخرج ادوار ملغاة و استخرج البروج و ما بعدها مما يبقى و احفظها ثم اقسم الاصل على ١٠٠٦٠ ليخرج دقائق و توابعها و انقصها مما حفظت فيبقى سرعة عطارد (لنصف الليل الذى بعد النهار المحسوب)

مثال :- اذا ضربنا الاصل فى ...٩ فصار ١٩٣٥٢٦٠٠٠ (نقصنا منه ٣٣٦٢٦٢ فبقى ١٩٣١٨٩٧٣٨) قسمنا على ٩١٢٧٨٤ فخرجت الادوار الملغاة ٢٣٥ و المحفوظ ح ح كط مو يه ثم قسمنا الاصل على ١٠٠٦٠ فخرج ها ها ب ط يه نقصنا ها من المحفوظ فبقى ح ح كز مز يه و هو سرعة عطارد (لنصف الليل الذى بعد النهار المحسوب) ○

(٣) معرفة استخراج وسط المشترى :

اضرب الاصل فى ١٠٠ و انقص مما بلغ ٣٨٩٨٣ و اقسم ما بقى على ٣٣٣٢٣٢ ليخرج ادوار تامة ملغاة و استخرج البروج و ما يتلوها مما يبقى و احفظها ثم اقسم الاصل على ٢٢٢٠٠ ليخرج ثوانى و انقصها مما معك فيبقى وسط المشترى (لنصف الليل الذى بعد النهار المحسوب) ○

مثال :- اذا ضربنا الاصل فى ١٠٠ فاجتمع ٢١٦١٣٠٠ و نقصنا منه ٣٨٩٨٣ فبقى ٢١١٣٥٠٢ قسمناه على ٣٣٣٢٣٢ فخرجت الادوار الملغاة اربعة و المحفوظ مما بقى ى يو يد له يه ثم اقسم الاصل على ٢٢٢٠٠ فخرج ها ها ا يه نقصناه من المحفوظ فبقى ى يو يد لد يه و هو وسط المشترى (لنصف الليل الذى بعد النهار المحسوب) ○

(٣) معرفه استخراج سرعه الزهره :-

اضرب الاصل فى ٦٠٠ و رد على ما اجتمع ١٣٨٦٢ و اقسمه على ٢٣٣٨١٩ فيخرج ادوار ملغى و استخرج البروج و ما يتلو ها مما يبقى و احفظوا ثم اقسم الاصل على ٩٩٨٠ فيخرج دقائق و ما بعدها فا نقصها مما عندك فيبقى سرعه الزهره (لنصف الليل الذى بعد النهار المحسوب) ٥

مثال :- اذا ضربنا الاصل فى ٦٠٠ فصار ١٢٩٦٨٣٠٠ و ردنا عليه ١٣٨٦٢ فبلغ ١٢٩٨٢٢٦٢ قسمناه على ١٢٣٨١٩ فخرجت الادوار المطروحة ٩٦ (و المحفوظ ح يح ل مط نيه ثم قسمنا الاصل على ٩٩٨٠) فخرج ها ها ب ى نيه نقصناه من المحفوظ فبقى ح يح كح لط نيه و ذلك سرعه الزهرة (لنصف الليل الذى بعد النهار المحسوب)٥

(٥) معرفه استخراج وسط زحل :-

اضرب الاصل فى ٣ و انقص مما اجتمع ٦٤٨ و ثلثى و اقسم ما بقى على ٣٣٠٦٢ فيخرج ادوار ملغى و استخرج البروج و ما يتلو ها من الباقى و احفظها ثم اقسم الاصل على ٣٨٤٦ فيخرج ثوانى ينقصها مما معك فيبقى وسط زحل (لنصف الليل الذى بعد النهار المحسوب) ٥

مثال :- اذا ضربنا الاصل فى ٣ فصار ٨٦٣٥٦ و نقصنا منه ٦٤٨ م فبقى ٨٥٤٤٤ ك قسمناه على ٣٣٠٦٢ فخرج دور واحد و مما بقى يا كر ، ر نيه حفظناه ثم قسمنا الاصل على ٣٨٤٦ فخرج ها ها ها و نيه نقصناه مما حفظنا فبقى يا كز ، ا نيه و ذلك وسط زحل (لنصف الليل الذى بعد النهار المحسوب) ٥

THE TRIGONOMETRY OF AL-BĪRŪNĪ

DR AHMED SAIDAN
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THE trigonometry of al-Bīrūnī is well presented to the scholarly world through Carl Schoy's *Die trigonometrischen Lehren des al-Bīrūnī* (Hanover 1925) One concept herein involved was also expounded by Schoy in his *Al-Bīrūnī's Method of Approximation of Chord* 40° [*American Mathematical Monthly*, 33 (1926), pp 95-96] Both, as well as M A Kazim's *Al-Bīrūnī and Trigonometry*, published in the commemoration volume of 1951, were built upon sections of al-Bīrūnī's monumental work, *al-Qānūn al-Mas'ūdī* The present paper is a study of a work by al-Bīrūnī devoted fully to trigonometry, namely, *Istikhrāj al-Awtār fī al-Dāirah bi-Khawāṣṣ al-Khaṭṭ al-Munhanī fīhā*— Deriving the chords in a circle by the properties of the line broken in it Probably, this work is the first ever devoted to trigonometry as such It seems to be the background of the trigonometrical sections in al-Bīrūnī's *Canon* It is the work referred to in *Das Buch der Auffindung der Sehnen in Kreise, ubersetzt und mit Kommentar versehen von Heinrich Suter* (Bibliotheca Mathematica, Vol II, pp 11-78 1910)

To review a work already studied and commented upon by an excellent scholar like Suter cannot probably be passed without justification In the present case, the justification is not difficult to present Suter reviewed ms Leyden, 1012, whereas the present study reviews the ms of Bankipore, Patna, published by the Hyderabad Publication Bureau, in 1948 The former manuscript is in 21 folios, whereas the latter fills 226 pages of the Hyderabad publication The two are so alike that they cannot be but one and the same work, and so different that the difference cannot be a scribal mistake It seems that the Hyderabad copy gives the work in full, and the Leyden copy gives an abridgement thereof by the pen of al-Bīrūnī himself In this abridgement, some details at the beginning, and the more complicated parts at the end are omitted and the intermediary substance is rather better arranged and better worded

It should be pointed out that more than half the 226 pages in the Hyderabad publication do not belong to the work under consideration Some of these

form parts of *Rasā'il Ibn Sinan* published by the same Bureau, and some are parts of at least two works by al-Bīrūnī hitherto thought to be lost To republish these works properly arranged and annotated is a scholarly rewarding project that the pressure of other duties has prevented me from accomplishing The part from page 1 to page 108 and that from page 224 to the end of page 226 cover, almost in full, the treatise we here review

[2] Like all medieval mathematicians, al-Bīrūnī conceived chords in a circle as sines of angles If Θ is an angle at the centre of a circle of radius r, and crd Θ is the chord subtended by this angle, then it is easy to see that

$$\text{Crd}\ \Theta = 2r \sin\frac{\Theta}{2} = d \sin\frac{\Theta}{2}$$

This is how the Greeks, the Indians and the Muslims understood the sine function Al Bīrūnī was the first to concentrate on the circle where $d = 1$, and thus to him $\text{crd}\,\Theta = \sin\frac{\Theta}{2}$

Finding out the length of crd Θ therefore meant finding out $\sin\frac{\Theta}{2}$ The angle was often denoted by its measure in degrees, but also as a fraction of the complete revolution Thus crd $\frac{1}{4}$, crd $\frac{1}{9}$ denote respectively crd 90°, crd 40° and equal the values of sin 45° and sin 20° Apart from 30°, 45°, 60° whose sines can be readily given by elementary knowledge, crd Θ and sin Θ were obtained by utilizing Ptolemy's theorem, namely, in a cyclic quadrilateral, the product of the diagonals is equal to the product of one pair of opposite sides added to the product of the other pair Six chords are here involved Taking these in special cases, the rules for $\sin(90° - \Theta)$, $\sin(\pm\alpha)$, $\sin 2\alpha$ can be derived Of the theorems in *Euclid's Elements*, Ptolemy's is the only one which leads to these results, which are inevitable for obtaining the sine table, of course with approximation

[3] Al-Bīrūnī finds the journey from Ptolemy's theorem to the sine table too long and suggests another method for —

(i) deriving the essential trigonometric formulas, and

(ii) obtaining more easily and probably more accurately, the values of the sines

He suggests as alternative to Ptolemy's theorem four geometrical relations which he proves to be equivalent, in the sense that if one is proved, the others follow from it H. does not claim discovery of any of these theorems On the contrary, the greater part of his work is a collection of the different proofs thereof suggested by others, mostly Muslims, but including Archimedes

Giving several proofs to one and the same theorem looks strange, not only to us, but also to al-Bīrūnī's contemporaries In his introduction, he objects that Ibn Sīnā reckoned such a collection "fuḏhūl" which means "redundant" and implies the sense of being a waste of time and effort. Al-Bīrūnī defends himself by stating that collecting these proofs (i) gave him chance to stay in company with great minds and (ii) is not redundant since it has led to results that are the poles on which the science of astronomy stands

From our point of view, what led to these results are the four theorems and not the multiplicity of the proofs thereof But we appreciate this multiplicity because it gives names of mathematicians that are otherwise unknown to us and proves the existence of some books that otherwise we may doubt that they ever existed

Here are the four theorems

(1) If in a circular arc, a straight line is broken to form two unequal chords' and, from the midpoint of the arc, a perpendicular is dropped to the line it will bisect it

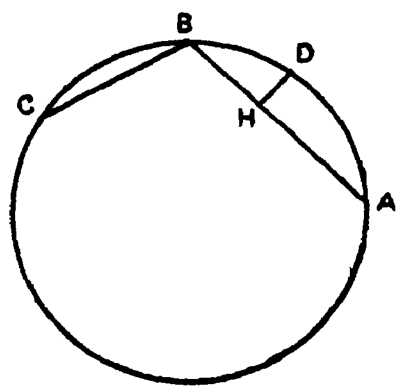


Fig 1

Thus in figure 1, ABC is an arc, and ABC is a broken line forming the two chords AB, BC D is the midpoint of arc ABC, and $DH \perp AB$ According to the theorem, $AH = HB + BC$

(2) As in the line ABC (Figure II), if D is the midpoint of AC, then $AB\ BC + \overline{DB}^2 = \overline{AD}^2$, so it is in arc ABC (Figure I), D being its midpoint

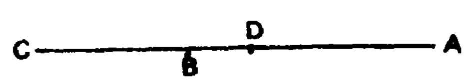


Fig 2

$$\text{chord } AB \ \text{ chord } BC + (\text{chord } DB)^2 = (\text{chord } AD)^2$$

This result is expressed in sine form as follows

$$\sin \text{arc } AB \ \sin \text{arc } BC + \sin^2 \text{arc } DB = \sin^2 \text{arc } AD$$

This means that an arc is measured by the angle it subtends at the circumference

(3) **If an arc is bisected and another arc is adjoined to it, their chords have this same property**

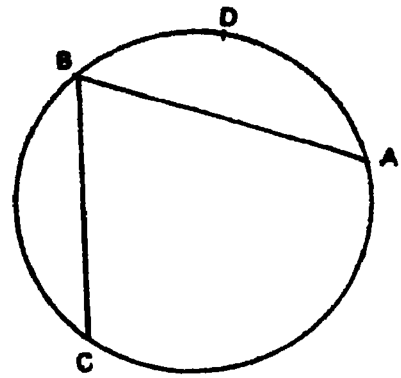


Fig 3

Thus if in Figure III, D is the midpoint of arc AB, and BC is adjoined, then chord AC chord BC + (chord BD)^2 = (chord DC)^2

(4) DH HB= ΔADC— ΔABC (Figure I) It is pointed out that of all triangles standing in a circle on the same base the isosceles has the greatest perimeter

[4] By the middle of page 49, al-Bīrūnī is through with these theorems and the several proofs of them Now he starts the second part of his work, namely constructions that are made easy by these theorems

1 to 4 From two given points to draw two lines intercepting a given angle and having

(1) the sum of their lengths equal to a given length,
(2) the difference between their lengths equal to a given length,
(3) the product of their lengths equal to a given area,
(4) the ratio between their lengths equal to a given number

It is stated that Menelaus gave a lengthy method for No 1, and so did Thābit Ibn Qurra, that Abū Sa'īd al-Sijizi gave a very simple method, and that the method of al-Bīrūnī is claimed to be as simple

No 4 is said to have no bearing upon the theorems under consideration but is appended here because with the first three it makes a sequence

5 In a given circle to construct a triangle with a given perimeter

6 A proof of Archimedes rule of altitudes of triangles, namely, if a, b, c are the lengths of the sides of Δ ABC, and a perpendicular is dropped from A to BC, then c is divided into two segments and

$$\frac{1}{2}\left(c + \frac{a^2 - b^2}{c}\right) = \text{the greater segment, and}$$

$$\frac{1}{2}\left(c - \frac{a^2 - b^2}{c}\right) = \text{the smaller segment}$$

7 A proof of Archimedes rule for the area of the triangle namely, if a, b, c are the sides, $s = \frac{1}{2}(a+b+c)$, Δ=the area, then,

$$\Delta = \sqrt{s\,(s-a)\,(s+b)\,(s-c)}$$

8 **A proof of the Indian rule for the area of the cyclic quadrilateral namely, if a, b, c, d are the sides, s the semi perimeter and A the area, then** $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$

9-15 New proofs of certain theorems related to, and new methods of calculating, some astronomical constants, like the greatest inclination (of the sun), the area of the eclipsed portion of the heavenly body (sun or moon), etc

16-17. Two problems that "often appear in books of algebra" The first is the problem of the rod: A rod stands upright on level ground, required to break it so that when it is bent it reaches the ground at a given distance from its foot, where should it be broken.

The second is the problem of the two palm trees These are of different heights and at opposite sides of a river of given width Two birds stand on their summits A fish appears in the water and the birds dash to catch it They reach it at the same time Where in the river does the fish appear ?

This part of the work ends by pointing out that there may be other methods to solve or prove the foregoing problems and theorems, but the methods presented in the book aim at utilizing the four theorems stated in the early pages

[5] Discussion of chords as such starts towards the end of page 84 The following points are established

(1) Chords vary according to their arcs If one chord is given all others can be expressed in terms of it They are bound in greatness by the diameter, which is the greatest chord But there is no bound to their smallness We therefore express them as fractions of the diameter

In what follows, d = diameter, α, β, λ are arcs whose chords are a, b, l , crd $\frac{1}{n}$ = chord of the arc which is $\frac{1}{n}$ of the circumference

(2) crd $\frac{1}{6} = \frac{d}{2}$ This is the first chord to know and the only rational one

(3) crd $\frac{1}{10} = \sqrt{(\frac{d}{2})^2 + \frac{1}{4}(\frac{d}{2})^2} - \frac{d}{4}$

This is certainly the same as $\frac{d}{4}(\sqrt{5}-1)$, but the first form agrees literally with the wording of the author

(4) crd $(\frac{1}{2} - \alpha) = 2\sqrt{\frac{d+a}{2}\left(d - \frac{d+a}{2}\right)}$

This is said to be the same as, but easier to calculate than, $\sqrt{d^2-a^2}$, for this involves squaring two quantities

(5) Applying (4) to (2) and (3) makes two more chords known

He obviously means crd $(\frac{1}{2}-\frac{1}{8})$, crd $\frac{1}{2}-\frac{1}{16}$)

(6) crd $2\lambda = \left\{ l\sqrt{(d^2-l^2)\frac{1}{4}} \div \frac{d}{2} \right\}^2$

(7) crd $\frac{1}{2}\lambda = \sqrt{\left(\frac{d-\sqrt{d^2-l^2}}{2}\right)^2+\left(\frac{\alpha}{2}\right)^2}$

(8) Thus, with crd $\frac{1}{8}$ known, the following can be calculated

crd $\frac{1}{8}$, crd $\frac{1}{2}\times\frac{1}{8}$, crd $\frac{1}{4}\times\frac{1}{8}$,

And with crd $\frac{1}{16}$, crd $\frac{4}{16}$, and crd $\frac{1}{8}$ known, their multiples and sub-multiples can be calculated,

Also from crd $\frac{1}{2}$, crd $\frac{1}{4}$ is obtained which is $\sqrt{\frac{d^2}{2}}$, and thus crd $\frac{1}{8}$ can be obtained

(9) crd $\frac{1}{8} = \sqrt{(\frac{d}{2})^2-(2\text{ crd }\frac{1}{4}-(\frac{d}{2})\frac{d}{2}}$

Thus crd $\frac{1}{2}$ $\frac{1}{8}$ can be obtained

(10) crd $(\alpha+\beta) = d^2 - \left[\left\{\frac{d}{2} - \left(\left[\left|\sqrt{\frac{d^2-a^2}{4}}-\sqrt{\frac{d^2-a^2}{4}}\right|^2 + (\frac{a+b}{2})^2\right)\div d\right\} \quad 2\right]^2$

(11) crd $\frac{1}{2}(\alpha+\beta) = \sqrt{\left(\sqrt{(\frac{d}{2}+\frac{b}{2})(\frac{d}{2}\ \frac{b}{2})}-\frac{d^2-a^2}{4}\right)^2+(\frac{a+b}{2})^2}$,

$\beta<\alpha$

(12) crd $(\alpha-\beta)=\sqrt{d^2-\left\{d-\left[\left|\sqrt{\frac{d^2-a^2}{4}}-\sqrt{\frac{d^2-b^2}{4}}\right|^2+(a-\frac{a+b}{2})^2\right]\div d\right\}^2}$

(13) Let $C_1 = b\ \frac{1}{2}$ crd $(180-\alpha)$

$C_2 = \sqrt{\frac{2}{a} - |C_1^2 - b^2|} \div \frac{d}{2}$.

then crd $(\alpha+\beta) = C_1 + C_2$

crd $(\alpha-\beta) = C_1 - C_2$

(14) Let $C = b\ \frac{1}{2}a - \frac{d}{2}$

then crd $(\alpha+\beta) = \sqrt{|a^2-c^2|} + \sqrt{|b^2-c^2|}$

crd $(\alpha-\beta) = |\sqrt{a^2-c^2} - \sqrt{b^2-c^2}|$

(15) b. $\text{crd}(180 - \alpha) \div d = C_1$

$\text{crd}(\alpha - \beta) = \sqrt{a^2 - b^2 + C_1^2} - C_1$

a. $\text{crd}(180 - \beta) \div d = C_2$

$\text{crd}(\alpha + \beta) = C_1 + C_2$, $\text{crd}(\alpha - \beta) = C_1 - C_2$

$$\frac{a^2 - b^2}{\text{crd}(\alpha - \beta)} = \text{crd}(\alpha + \beta)$$

These results are attributed to Abū Nasr, Ibn 'Irāq

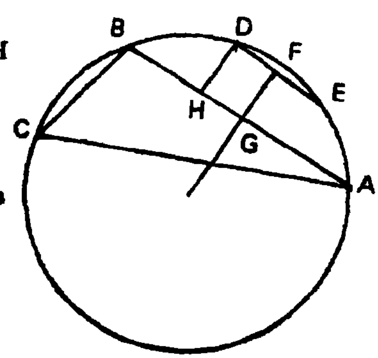
(16) $$\frac{a^2 - \left(b^2 + \text{crd}^2(\alpha - \beta)\right)}{\text{crd}(\alpha - \beta)} + \text{crd}(\alpha - \beta) = \text{crd}(\alpha + \beta)$$

It is probably unfair both to al-Bīrūnī and to the history of science to claim that the rules 9 to 16, expressed by my alphabetic symbolism, represent the statements of the great author They certainly do not, but are what his results amount to if expressed in this symbolism What al-Bīrūnī did was invariably

(i) to show by Euclidean reasoning that the required chord can be calculated, and

(ii) to formulate the process of calculation built upon that reasoning To show more clearly how this is done, I give here, in some detail, al-Bīrūnī's enunciation of rule no 10, viz $\text{crd}(\alpha + \beta)$:

In the figure, AB,BC are given chords in a circle, center O, required to find chord AC



From D, the midpoint of arc ABC, DH is dropped ⊥ AB ⇒ $AH = \frac{1}{2}(AB + BC)$, according to theorem 1

$AD = \text{crd}(\frac{1}{2}\text{ arc } ABC)$ Thus if AD is found, AC can be derived

But $\overline{AD}^2 = \overline{AH}^2 + \overline{DH}^2$

To calculate DH, DE is drawn // AB and OGF is dropped ⊥ DE $OG = \frac{1}{2}$ crd (180 - arc AB), $OF = \frac{1}{2}$ crd (180 − arc BC)

Therefore AD and hence AC can be found The process is as follows :

"Subtract the product of each one of the two chords by itself from the product of the diameter by itself, and take the square root of each remainder Multiply the difference between the two square roots by itself, and add to that the product of half the sum of the two chords by itself

Divide the result by the diameter and subtract the quotient from the radius Double the result and multiply this double by itself, subtract this from the diameter The square root of the remainder is the chord of the sum of the two arcs"

Of course, our symbolism may reduce these steps considerably, but we here study how al-Bīrūnī presented the problem

[6] On pages 101-104, the following are solved

(1) To find crd $(180 - \alpha)$, given crd $\alpha = a$, $d +$ crd $(180 - \alpha) = b$, but d unknown The problem is said to be like that of the rod

The formulas here given are —

$$\text{(i)}\quad \tfrac{1}{2}b + \frac{a^2/4}{\tfrac{1}{2}b} = d$$

$$\text{(ii)}\quad \tfrac{1}{2}b - \frac{a^2/4}{\tfrac{1}{2}b} = \text{crd } (180 - \alpha)$$

(2) If a, b are two chords in a circle, d unknown, but crd $(180 - \alpha) +$ crd $(180 - \beta) = C$, then

$$C + \frac{|a^2 - b^2|}{C} = \text{crd } (180 - \beta)$$

$$C - \frac{|{}^2 - b^2|}{C} = \text{crd } (180 - \alpha)$$

(3) If $AC = d$, $AB + BC = K$, to find AB, BC

Let $\sqrt{\tfrac{1}{2}d^2 - (\tfrac{1}{2}k)^2} = C$, then, the two chords are $\tfrac{1}{2}K \pm C$

(4) If AC is known, and AB BC is known, to find AB, BC

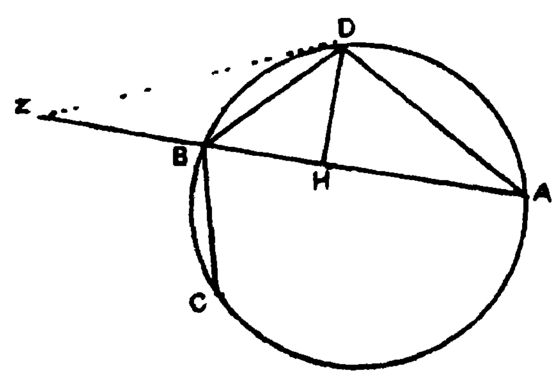
[7] At this stage, the Leyden ms. is concluded with the statement that the rules available yield crd 3° and crd $\frac{3^\circ}{2^{n}}$, but not crd 1°

MS Hyderabad however, as from page 105, gives the following

(1) The problem is to find crd $\frac{\theta}{3}$ given crd θ

Let ADB be an arc whose chord AB is known

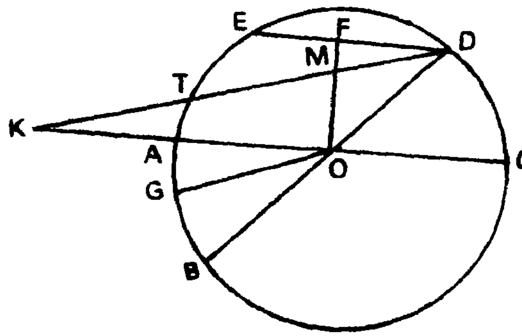
If arc BC = arc BC = $\tfrac{1}{2}$ arc AD, then according to al-Bīrūnī's four theorems, the problem can be solved, if the HD perpendicular is such that BD = BC



Again if Z is taken along AB, and BZ=BC = BD, it is proved that ZD is tangent to the circle If Z can be taken such that BZ = BD, the problem is solved.

(2) No one has been able to solve the problem geometrically. Al-Kindi and the ancients solved it mechanically, and later mathematicians used the properties of the hyperbola

(3) The author gives a method for approximate trisection of an angle and thus for finding crd $\frac{\Theta}{3}$ This covers pages 107, 108 and 224 to 226, where the book ends It runs as follows



Let AB be a given arc of circle centre O Draw the diameters AOC, BOD Produce CA and draw DE//CA, OF $\perp$ DE Manage to draw DMTK such that TK is equal to the radius Then DK trisects $\measuredangle$ ODE, and if OG//DK, OG trisects arc AB These results are proved, and the following is given to find crd $\frac{\Theta}{3}$ If AOB = Θ, OF = $\frac{1}{2}$ crd 2Θ Take ΘM a little greater than $\frac{2}{3}$ OF OM is the required chord But OM MF must be equal to KM MD, if they are not, we have to change the value of OM

[8] What about the other pages in the text?

Over ten years ago, I published a note in *Islamic Culture* showing that the substance in the two Hyderabad publications, *Rasā'il al-Bīrūnī* and *Rasā'il Ibn Sinān* are badly mixed In that note I managed to rearrange the pages according to content, and pointed out that the final word comes after seeing the manuscripts and drawing evidence from page ends During the past ten years I have succeeded in obtaining a microfilm of these manuscripts but the critical pages are unfortunately unreadable My conclusions are therefore still according to content

Accordingly, it seems to me that

(1) Pages 109-137, 154-180 make up the greater part of a work by al-Bīrūnī, which I take to be the so-called Ḥall al-Ta'dīl It is probably No 11 in Boilot's collection (Institut Dominicain d'Etudes Orientales, 1955) It is complete except for the opening lines and probably a few pages at the end

(2) Pages 139-153 are parts of a work by Ibn Sinān named *Masā'il Handasiyah*

(3) **Pages 180-184 seems to be part of a work by al-Bīrūnī on asymptotic behaviour It is probably No. 67 in Boilot's collection, namely: *Maqālah fī amr al-Khattain allazain Yaqrubān wa lā yaltaqiyān.***

(4) **Pages 185-201-218 (to be rearranged) should go to Ibn Sinān's** *Ḥarakat al-Shams*

(5) *Pages 219-223* **seem to be the first pages of another work by al-Bīrūnī,** probably Boilot's No 4, namely

Takmīl Zīj Habash bi al-Ilal

I take leave to say again that a critical edition of the two **Hyderabad** publications is highly rewarding

[9] With *Ifrād al-Maqāl fī amr al-Zilāl,* also included in Hyderabad publication, the *Istikhraj* completes al-Bīrūnī's contributions to trigonometry which are well presented in his *Canon* They make some of the earlier works was devoted to trigonometry as such, the earliest being probably *al-Shakl al-Qattā'* by Thābit ibn Qurrah

A PART OF AL-BĪRŪNĪ'S ISTIKHRĀJ AL-AUTĀR FI AL-DĀ'IRAH

MUHAMMAD SAUL

INTRODUCTION

The Istikhrāj al-Autār fi al-Dā'irah' is a geometrical treatise which deal with the theorems concerning the chords in the circles Its original Arabi text was published by Dā'irah al-Ma'ārif al-Uthmāniyah Hyderabad Deccan India, in 1948 A D

In this treatise al-Bīrūnī (973 - 1048 A D) gives a number of methods t prove a particular theorem so that, as he says, the readers may note how differen means can be adopted to achieve a certain goal The present translation woul provide a specimen of the pattern followed by him in the whole work

This treatise is of a great historical value because it contains the methods o a large number of mathematicians including those of the author himself Th fact that these mathematicians belong to different ages and different races reveal the wide extent of his knowledge of geometry and his keen interest in it Th treatise would prove more beneficial for the historians of mathematics if it i translated into English and other international languages

Theorem I

If from the end points of an arc two unequal straight lines are drawn, to common point at the arc, and if from the middle point of the arc a perpendicula is drawn on the bigger line, then the sum of the smaller line and the smaller par of the bigger line, is equal to the bigger part of the bigger line

That is, in the given fig 1 ABC is the arc, D is the middle point of the ar ABC, DE is perpendicular on AB then $AE = EB + BC$

$ED + BC$

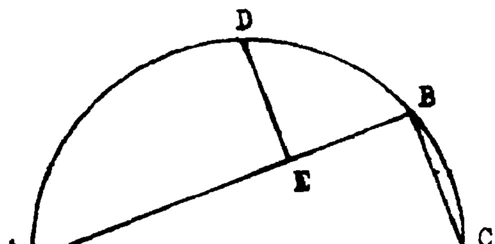


Fig. 1

Proofs of the theorem by

1 Adharkhaur Bin Ashtadh Jashnash

Produce CB (to Z) and draw on it a perpendicular DZ from D (fig 2) Join AB and DC Thus two triangles DZC and DEA are formed In these two triangles DZC and DEA are right angles (by construction) Also ZCD = EAD (angles subtended on the same arc DB) So the corresponding angles of these triangles are equal

AD = DC (as D is the middle point of the arc ABC)

DZ = DE and CZ = AE

Now DB is the common hypotenuse of

$\triangle$DZB and of $\triangle$ DEB

But DZ = DE and so ZB = EB

But the whole CZ = AE

Hence CB + BE = CZ
BE = AE

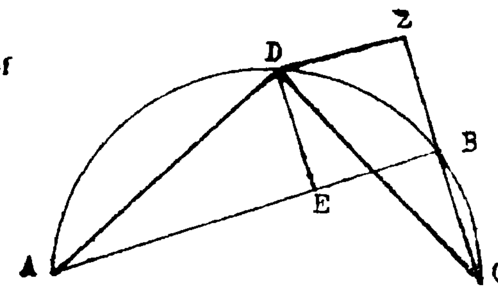


Fig. 2

2 Archimedes in his '*Book of Circles*" and Sarinos in his "*Book of Geometrical Principles*"

Cut arc DF = arc DB, and join DB and DF, and cut EZ = EB

Also join DZ and DA (fig 3) Because perpendicular DE is common (in $\triangle$s DBE and DZE), the lines DZ and DB are equal

arc DB=arc DF,

the remaining arc FA = arc BC (. arc AD = DC)

$\therefore$ $\angle$FDA + $\angle$ DAB = $\angle$DBA (arc FA + arc DB = arc FA + arc FD = arc AD)

i e = $\angle$DZB ($\triangle$DZB is an isosceles $\triangle$)

But $\angle$DZB = $\angle$ZAD+ $\angle$FDA

$\angle$ZDA = FDA ($\therefore$ $\angle$ZAD = $\angle$DAB)

and DZ = DF

Since DA is common, therefore the bases AZ and AF are equal

But AF = BC

∴ AZ = BC and ZE = EB

AZ + ZE = EB+BC

Hence AE = EB+BC

3 Abū Sa'īd al-Darīr of Jurjān

Abū Sa'īd also proves it in the same way He starts the solution by proving the equality of the sides of the triangles AFD and AZD (fig 3) But he begins this proof by cutting the arc AF = the arc BC So out of these two equal arcs, there remain two equal arcs DF and DB This implies the equality of the angles

FAD and ZAD

Now cut AZ = AF

So the bases FD and ZD are equal

But FD = DB

DB = DZ and

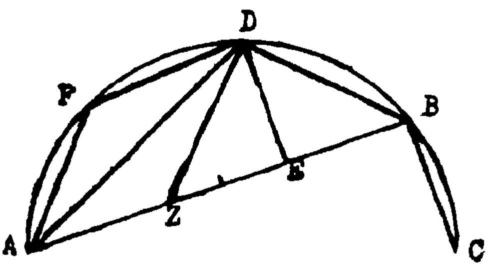


Fig. 3

⊥ DE, divides the base ZB into two equal parts

AZ+ZE=EB+BC

It is just by chance that I also gave the same proof in my book entitled "*Taṣḥīḥ al-Ma'qūl Bayn al-'Arḍ Wal Ṭūl*"

4 Abū 'Alī al-Ḥasan Ibn al-Ḥussayn al-Basarī

Abū 'Alī also starts the solution by showing the equality of triangles AFD and AZD But he proves this equality in a different way (fig 3)

He cuts the arc DF = the arc BD

∠FAD= ∠ZAD (angles on the equal arcs)

He then cuts EZ = EB and join DZ

This shows that DZ = DB

Then he says that the figure AFDB in this circle is a quadrilateral

So ∠AFD and ∠ABD in it are equal to two right angles

But ∠DZB = ∠DBZ and so AFD and DZB are equal to two right angles

∠AFD = ∠AZD

The rest of the proof is as above

5 Abū Sa'īd Aḥmed bin Muhammad bin 'Abd al-Jalīl al-Sijzī

Some others solved this problem by cutting the arc DF = arc BC (fig 4) Abū Sa'īd draws DF parallel to AB and FT parallel to DE Thus due to the equality of two angles ADF and BAD the arc AF = arc DB, there remain two equal arcs FD and BC, which are the parts of two equal arcs (AD & DC)

Also the chord FD = TE and

∴ AT = EB

AT + TE = EB + BC

Hence AE = EB + BC

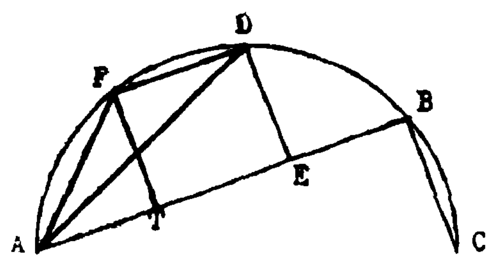


Fig. 4

And due to the abundant use of this proposition, I adopt this pattern in treating some of them I draw the diameter DKN and produce DE to meet the circumference at L (fig 5) Then I draw NF ∥ DL In this way two equal arcs DCL and NAF are formed Then I join FD

Now ∠TFD = right angle, because it is subtended in the semicircle DCN (∵ ∠TFD = ∠NFD)

The surface DETF is a rectangle

FD = TE

Then I draw from the centre K the lines ED, which being——on the chords, AB & FD I cut each of them into two equal parts

∴ FS = SD and TM = ME

The remaining parts AT and EB are equal and

FD = TE = BC,

∴ AT + TE = EB + BC

Hence AB = EB + BC

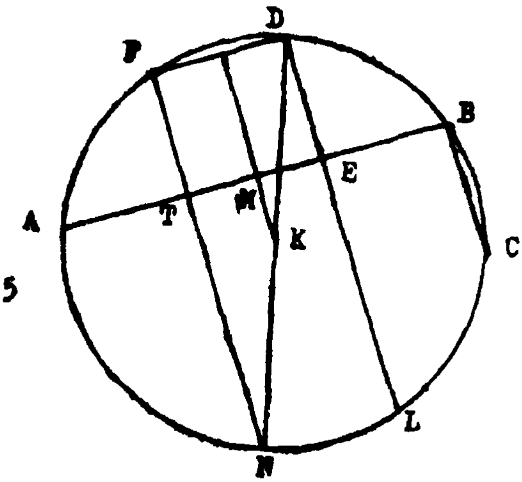


Fig.5

6 Abū 'Abd Allah Muḥammad ibn Aḥmad al-Shīnah

His method is approximately the same He joins NL (fig 6) The surface TELN is rectangular due to the equality of two ⊥s LE and NT and of sides AT and EB The diameter DN cuts the chord AC into two equal parts So the angle P is a right angle and the corresponding angles of triangles APQ and DQE are equal

∴ ∠NDL = ∠BAC

so the chords NL and BC are equal, and as NL and TE are equal

∴ TE = BC

The remaining proof is as above

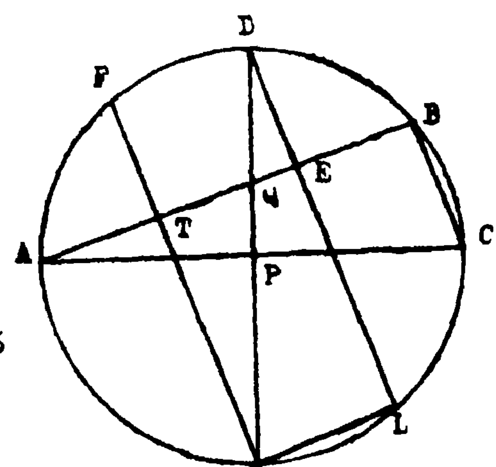


Fig.6

7 Qāḍī Abū Alī al-Ḥasan ibn al-Harth al-Habubī

Abū 'Alī gives a solution resembling the previous one He cuts the arc AF equal to the arc DB and joins AF (fig 7) He draws FT ⊥ AB Then he

indicates the equality of the angles T & E which are right angles, and of the angles FAT and DBE, because they are subtended on the equal arcs FDB & AFD and also the equality of the sides AF and DB

∴ AT = EB

and ⊥ FT = ⊥ DE

Since the lines joining the ends of equal and parallel lines are equal

∴ FD = TE,

And as FD and BC being the chords of two equal arcs are equal

AT + TE = EB + BC

Hence AE = EB + BC

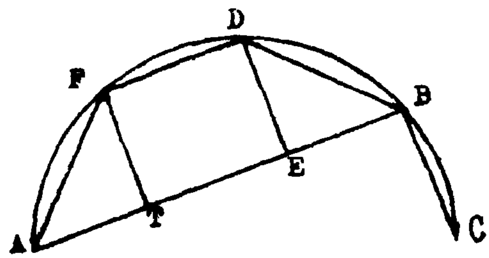


Fig. 7

8 Abū Naṣr Manṣūr bin 'Alī bin 'Irāq Maulā Amīr al-Mu'minīn

The geometricians tried to solve it by different methods without cutting the arc AD

Abū Naṣr al-Ja'dī cuts EZ = EB and joins DZ (fig 8)

He says that the line ZA cannot be bigger or smaller than BC If it possible let us suppose that it is greater than BC, then we may take AF = BC If it is possible, the lines AF and AD would be equal to the lines CB and CD respectively, and the two angles A & C are equal (as they are on the arc DB),

∴ the bases DF and DB are equal

But EZ = EB, and ⊥ ED is common

DZ = DB

Thus DZ and DF the sides of triangle ZDF are equal

∴ in triangle BDF ∠B = ∠F

∴ The external angle DZF of triangle DBZ is equal to the internal angle DBZ which is a contradiction

In the same way we can explain that it is impossible that ZA be smaller than BC

∴ it is equal to BC

The rest of the proof is as above

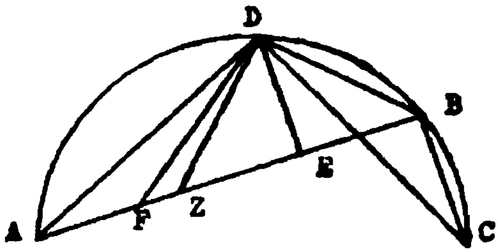


Fig. 8

At some other place I adopted another way of proving the equality of AZ and BC, which is as follows (fig 8)

$\angle DZB = \angle ZDA + \angle ZAD$

But $\angle DBZ = \angle DZB$

$\angle DBZ = \angle ZDA + \angle ZAD$ and $\angle DBZ$ is subtended on the half of the arc (i e AD) and $\angle ZAD$ is at the arc DB which is a part of second half of the arc (i e CD), so there remains the angle ZDA which is equal in magnitude to the angle which is subtended on the arc BC, a part of the second half of the arc

So $\angle ADZ = \angle CDB$ & $\angle A = \angle C$

∴ triangles AZD and CBD are proportional

∴ side AD = side DC

∴ Both the triangles are equal

hence AZ = BC

And in the book entitled *"Tahsīl al-Rāhat bi-Tashīh al-Masāhat"* I argued by making use of the fitness of the concave side of the arc on the convexity of the broken line (that is the joining lines AB and BC in the given figure), and not by comparing them, i e by the division of the broken line into two equal parts, with the division of the arc in such parts So I separated the angle ADZ equal to the angle BDC till the obtuse angles of the triangles ADZ and DCB became equal to the angles Z and B opposite to the equal sides AD & DC respectively

Hence AZ = BC

Thus it was proved

And I say in my explanation of the *'Zīj of Habsh'* that we cut EZ = EB and join DZ and DB So they became equal Then we join AD & DC, and produce CB to F (fig 9) Since the sum of the

∠DBC subtended on the arc and the
∠DAC subtended on the arc DBC, which is equal to the arc AD on which
∠DBA is formed, is equal to two right angles

∴ ∠DBA = ∠DAC = ∠DZE

and ∠DBC = ∠DZA

and ∠DAB = ∠DCB

Since DZ = DB

so △ AZD ≅ △ DBC

Hence AZ = BC

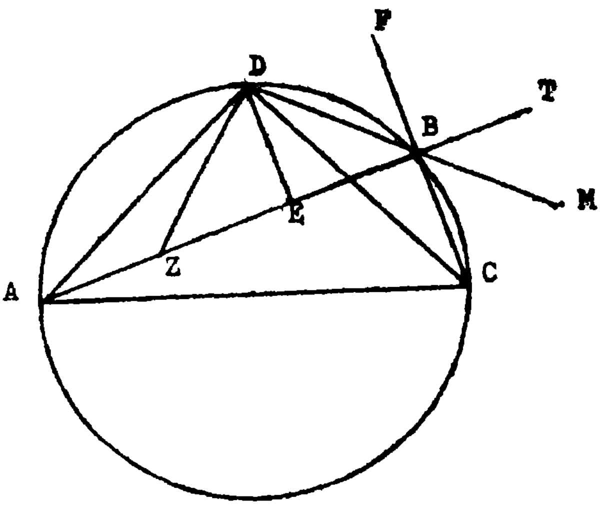


Fig.9

It may be said that the complementary angle of the angle DBC which make it equal to two right angles is the angle CBM which is subtended on an are equal in magnitude to the arc DBC

So ∠MBC = ∠DBA and ∠EBC is common

∠DBC = ∠EBM and

∠EBM opposite to ∠DBT is equal to ∠DZA

hence ∠DBC - ∠DZA

9 Abū'Abd Allah al-ShInah

He adopts a method to improve it He cuts EZ = EB and joins DZ and AC (fig 10) He says that in the isosceles triangles DZB and ADC, angles C and B are on the same arc

So the triangles are proportional

∠ADC = ∠ZDB

We neglect the common angle ZDM Thus the remaining angles ADZ and CDB are equal and the sides AD and DZ of triangle DAZ are equal to the sides CD and DB of triangles CDB respectively

∴ AZ = BC.

Hence AZ + ZE = BB + BC = AB)

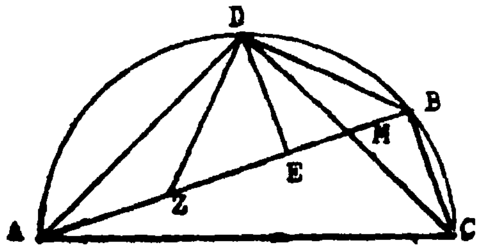


Fig. 10

10 Abū 'Alī al-Ḥabūbī

His procedure is as follows

He completes the circle and cuts EZ = EB and joins DB and DZ and produces DZ to meet the circle at F (fig 11) He joins AF and FC Then he says that the vertically opposite angles AZF and DZE are equal and the angles AFZ and DBE, subtended by the same arc (AD) are also equal

So $\angle AFZ = \angle AZF$

and $AF = AZ$

The angles AFD and DFC subtended on the equal arcs (AD & DC) are equal

$\angle DFC = \angle AZF$ (Since they are alternate opposite angles)

. $AB \parallel FC$

Thus the arcs AF and BC are equal

$AF = BC$

$AF = AZ$

Hence $AZ = BC$

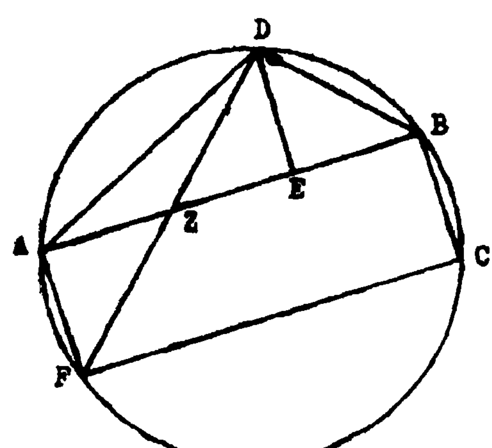


Fig. 11

11 Archimedes in his *Book of Circles*

There are some geometricians who improved it in some other ways as Archimedes in his *Book of Circles* and Sarinos in his *Book of Principles of Geometry* giving another proof different from what we have mentioned

He produces AB and cuts EZ = EA and joins DA, DC, DZ and DB (fig 12)

Since the chord AD = the chord DC and

AD = DZ

DZ = DC

Also $\angle DAB = \triangle DZB = \triangle DCB$

Since arc DA = arc DC,

and if we take the arc AFC as common, the arc DAFC should be equal to the arc DCFA But the angle DBC is subtended on the arc DAFC and the angles DAB and ADB are subtended on the arc DCFA, angle DAB is on the arc DB and angle ADB is on the arc BCA

$\angle DBC = \angle DAB + \angle ADB$

And the external angle DBZ of triangle ADB = $\angle DAB$ + ADB which are the internal opposite angles

So $\angle DBC = \angle DBZ$

And it has already been explained that $\angle DZB = \angle DCB$

the remaining angles CDB and ZDB are equal

Also DZ = DC

and DB is common
CB = BZ

Hence CB + BE
= ZE
= EA

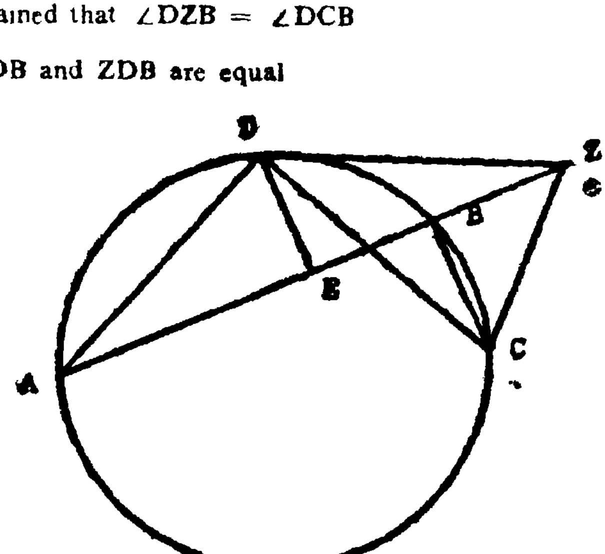


Fig. 12

12. Adharkhaur Bin Ashtadh Jashnash

Others have adopted another method to prove the equality of triangles DCB and DZB Adharkhaur joins CZ and explains the equality of the lines AD, DZ and DC and the equality of the angles A, Z and C as above. Then he says that Δ DCZ is isosceles in which DC = DZ and $\angle$DCZ = $\angle$DZC (fig 13)

When we subtract from them the equal angles DCB and DZB there remain the equal angles BCZ and BZC

Also BZ = BC

$\therefore$ BZ + BE = EB + BC

BZ = BC

BZ + BE = EA

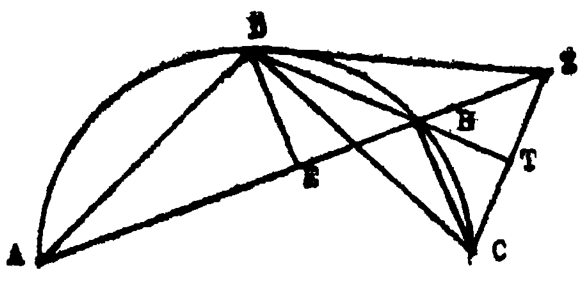


Fig. 13

13 Archimedes and some Greeks

Archimedes in his *Book of Circles* and Sarinos give a third proof (of this theorem) and I found exactly the same proof given by some Greeks I think it must be of Apollonius The Greek test was translated by Youhannah bin Yusuf

He says, since DC is a chord of circle the arc DBC, is smaller than half the circle and it is not possible that it be bigger than this, because arc AD is equal to this and it is not possible that there be equal arcs of a circle, each of which be bigger than half the circumference, without something being common in them, therefore the angle DBC which is opposite to it is an obtuse angle and since AD is a chord in the circle, the curve DCA is bigger than half the circle, therefore the angle DBA which is opposite to it is an acute angle There remain the obtuse angle DBZ, and $\angle$DBZ = $\angle$ DBC and DC = DC = DZ and their ratio to common line DB is the same, therefore in triangles DBZ and DBC, the angle C of one of them is equal to the angle Z of the other and the side forming these two angles are proportional

Each of the angles DBC and DBZ is greater than a right angle therefore the remaining angles are equal

Hence the triangles are congruent

And as I say in my book entitled *'Fi al-Masā'il al-Mufīdah wal Jawābāt al-Ṣadīdah'*, concerning the *'Zij of al-Khwārizmī* we produce AB (to Z) and make BZ = BC (fig)

We join CZ, DZ and DA, and draw a ⊥ BT on CZ

Since the side CB + the side ZB

∴ ⊥ BT divides the base CZ into two equal parts and so triangles TCB and TBZ are congruent and their corresponding angles are equal

Since the exterior angle DBC of triangle BTC = ∠BCT + ∠CTB (∠BCT and ∠CTB are internal opposite angles)

and ∠BTZ + ∠ZBT = ∠BCT + ∠CTB

∴ ∠ABT = ∠DBC

and ∠ABT + ∠TBZ = ∠DBC + ∠CBT

But ∠ABT + ∠TBZ = two right angles

∠DBC + ∠CBT = two right angles

Thus DBT is a straight line

But it is ⊥ of the △ DZC, which is dividing its base into two equal parts

DC = DZ

Since AD = DC

AD = DZ

⊥ DE divides AZ into two equal parts

So AE = EB + BZ

But BZ was supposed to be equal to BC

Hence AE = EB + BC

14 Abū Sa'īd al-Sijzī

Abū Sa'īd produces AB to Z in such a way that BZ becomes equal to BC (fig 14) He joins the points as in the previous case Now due to the equality of BC & BZ, the angles BCZ and BZC are equal and the exterior angle ABC is

equal to them, so it is double of one of them (∵ The angle which an arc of a circle subtends at the centre is double that which it subtends at any point on the remaining part of the circumference)

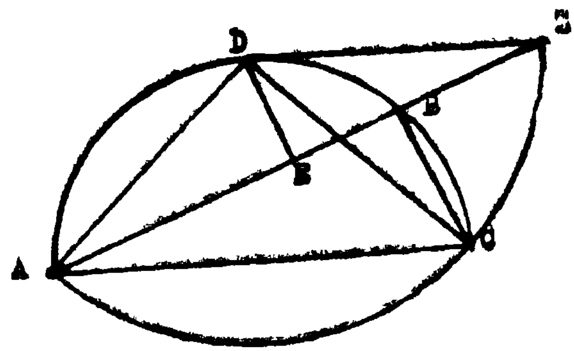


Fig. 14

So angle ADC which is equal to angle ABC is double of the angle BZC, so the circle drawn with the centre D and the radius DA will pass through the point C & Z The angle ADC at its centre and the angle AZC at its circumference are subtended on the same segment (AC) of it

$AD = DZ$

and $\angle DAE = \angle DZE$, and $DE \perp AEZ$

Hence $AE = EB + BZ$

$AE = BC + EB \quad BC = BZ$

Some other geometricians adopted another method to prove the equality of AD and DZ According to them the angles DAC and DCA are equal and the sum of the angles ABD and DBC is equal to two right angles and also the sum of the angles DBA and DBZ is equal to two right angles

$\angle DBZ = \angle DBC$,

and the sides ZB and BC are like the sides CB and BD respectively, and so the bases DZ and DC are equal

$DC = DA$

Hence $DZ = DA$

15 Abū Sa'īd al-Jurjānī

The method of Abū Sa'īd al-Darīr is to produce AD to F such that DF=DA (fig 15)

He draws a semicircle with centre D and radius DF, which necessarily passes through the points A and C He then produces AB to its circumference (Z) and joins ZC and DC

As in the previous case, he mentions that BZ = BC because it is the case with every straight line which comes out from A, cutting the circle ADB such that when its segment is joined with the point C, the joining line becomes equal

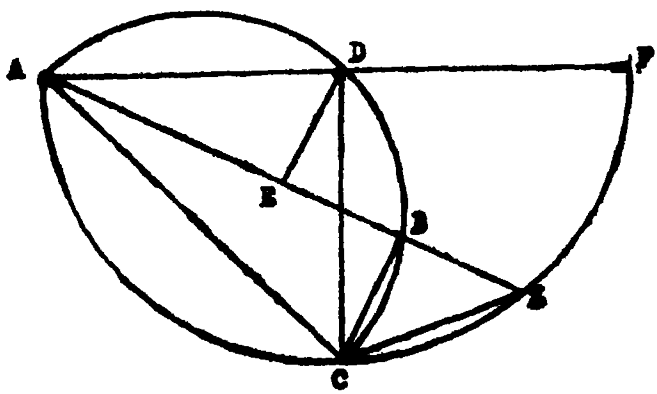


Fig. 15

to that part of it which lies between two circles, then he takes EB as common

$$CB + BE = ZE$$

But DE is perpendicular drawn from the centre of the circle ACZ at the chord AZ in it So it cuts it into two equal parts

$$AE = EB + BZ$$

i e $\quad = EB + BC$

16 Abū Sa'īd al-Sijzī

Abū Sa'īd treats this problem in a way resembling the one mentioned above He draws on AD a semicircle AED and joins ZC (fig 16) He says that the circles, ACF and AED are touching each other at A therefore the ratio of AD to DF is like that of AE to EZ

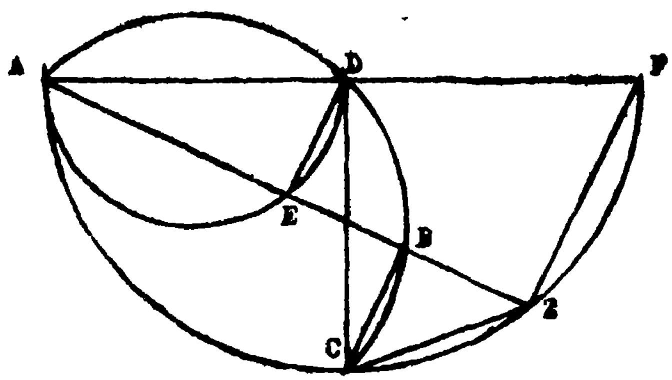


Fig. 16

Because the angles AED and AZF are right angles, in the triangles AED and AZF respectively which are proportional So AE is equal to EZ and the angle ADC is equal to the angle ABC at the centre and twice the angle AZC at the circumference Therefore angle ABC is double of the angle AZC But it is equal to the sum of the angles BZC and BCZ Therefore both of them are equal

So BC = BZ

The rest of the proof is as above

AL-BĪRŪNĪ AND THE HISTORY OF SCIENCE

PROFESSOR AYDIN SAYILI

AL-Bīrūnī wrote no special book on the history of science in general or on the history of any particular scientific field, but he was interested in these subjects, and he also constitutes a very important source for the history of science

It is certain that al-Bīrūnī did not conceive scientific knowledge as static He believed in the idea of the progress of scientific knowledge, quite naturally perhaps since he himself was actually engaged in advancing the forefronts and outposts of science in a considerable number of sectors or points

In speaking, in his *India*, of the differences of mental attitudes of the people of India as compared with those prevailing in the World of Islam, al-Bīrūnī says that in pre-Christian times, the Greeks held the same idolatrous views as the Hindus, and he goes on with the following words

"The Greeks, however, had philosophers, who, living in their country, discovered and worked out for them the elements of science, not of popular superstition, for it is the object of the upper classes to be guided by the results of science, whilst the common crowd will always be inclined to plunge into wrong-headed wranglings, as long as they are not kept down by fear of punishment Think of Socrates when he opposed the crowd of his nation as to their idolatry and did not want to call the stars, gods At once eleven of the twelve judges of the Athenians agreed on a sentence of death, and Socrates died faithful to truth

"The Hindus had no men of this stamp both capable and willing to bring science to a classical perfection Therefore you mostly find that even the so-called scientific theorems of the Hindus are in a state of utter confusion, devoid of any logical order, and in the last instance always mixed with the silly notions of the crowd, e g immense numbers, enormous spaces of time, and all kinds of religious dogmas, which the vulgar belief does not admit of being called into question Therefore it is a prevailing practice among the Hindus *jurare in verba magistri*, and I can only compare their mathematical and astronomical literature, as far as I know it, to a mixture of pearl shells and sour dates, or of pearls and dung or of costly crystals and common pebbles Both kinds of things are equal in their eyes, since they cannot raise themselves to the methods of strictly scientific induction "[1]

It is seen that al-Bīrūnī lays stress here both on freedom of thought, as exemplified in his reference to Socrates, and emancipation from superstitious beliefs and dogmas He believes that such an aim can be attained by giving due weight to scientific knowledge and that for such a purpose it is necessary to organise and discipline scientific thought with the help of analysing its nature and establishing its methods

Again, in his *India*, al-Bīrūnī writes: "The number of sciences is great, and it may be still greater if the public mind is directed towards them at such times as they are in the ascendancy and in general favour with all, when people not only honour science itself, but also its representatives To do this is, in the first instance, the duty of those who rule over them, of kings and princes. For they alone could free the minds of scholars from the daily anxieties for the necessities of life, and stimulate their energies to earn more fame and favour, the yearning for which is the pith and marrow of human nature

"The present times, however, are not of this kind They are the very opposite, and therefore it is quite impossible that a new science or any new kind of research should arise in our days What we have of sciences is nothing but the scanty remains of bygone better times

"If a science or an idea has once conquered the whole earth, every nation appropriates part of it So do also the Hindus Their belief about the cyclical revolution of times is nothing very special, but is simply in accordance with the results of scientific observation "[2]

Here al-Bīrūnī is observed to touch upon the progressive nature of scientific knowledge He sounds quite pessimistic with regard to the possibilities offered by his own time for the advance and growth of knowledge, but, as we shall see presently, on certain other occasions he spoke in more sanguine terms The above passage also contains a reference to the international nature of scientific knowledge

In another passage of his same book, referring likewise to the Hindus, al-Bīrūnī says: "They are by nature niggardly in communicating that which they know, and they take the greatest possible care to withhold it from men of another caste among their own people, still much more, of course, from any foreigner According to their belief, there is no other country on earth but theirs, no other race of man but theirs, and no created beings besides them have any knowledge or science whatsoever If they travelled and mixed with other nations, they would soon change their mind, for their ancestors were not as narrow-minded as the present generation is In former times, the Hindus used to acknowledge that the progress of science due to the Greeks is much more important than that which is due to themselves "[3]

In this passage al-Bīrūnī is seen to dwell upon the question of the importance of cultural contacts and scientific cooperation among nations, to which he makes more concrete and specific references in other writings of his. These ideas were not alien to the Islamic World where a concerted effort had been made to appropriate the scientific legacy of other nations through systematic and intense translation activities which lasted nearly two centuries

As to his more optimistic remarks concerning conditions favourable to the advancement of knowledge in his own time, he makes the following statements in his *Tahdīd*, written during the reign of Maḥmūd of Ghaznah

"After that full discussion of what I have presented, my intention is the determination of the longitude of a specified city on the surface of the earth, whose position will be known, relative to all other cities That city is Ghaznah but so far I have been able to determine its latitude only As to its longitude, by the methods discussed above, there were reasons which prevented its determination If I excuse myself for those reasons, my soul would feel ungrateful to God for the apparent and inner blessings He has bestowed upon me, and to my patron for the gifts and favours extended to me by his generous hand However, I do beseech the Almighty to grant me the facilities for making the researches which I have loved, for in their pursuit I have not flinched from imminent danger to both body and soul Nay, in those critical hours, I was always anxious to complete those researches before I pass away, and I requested Him to grant me a virtuous life here on earth, and in the hereafter

"I say Most of the terrestrial longitudes and latitudes mentioned in (Ptolemy's) book (called) the *Geography* were derived on the basis of the reported distances between the various localities on the surface of the earth Ptolemy himself certainly adopted the best methods, but others may or may not have followed him However, determinations were based on hearsay evidence

"In the past, communications between those kingdoms were obstructed and risky The divergence in the systems of beliefs adopted by their citizens was the main hindrance to travel between one kingdom and another This is observed in the rush of a man of one faith to assassinate another of a different faith, as an act of devotion to God This is what the Jews do also, it is observed, in dragging him into servitude, the safest of what might befall him This is what the Byzantines do, or in looking down on him as a stranger, and in hurling accusations at him, which ultimately drive him to extremes of hardships and privations that agonize the soul

"But now Islam had appeared in the eastern and western parts of the world and has spread between Andalusia in the west and parts of China and Central

India in the east, and between Abyssinia and Nubia in the south and the Turks and the Slave (Saqaliba) in the north It has united all the different nations in one bond of love, a handiwork which can be made by God only Fanaticism and racial prejudice have been swept away, and what remains is no more than the nuisance of corrupt and wicked highway robbers The remaining nations, who have insisted on rejecting the faith, are afraid of the might of Islam, they highly respect its followers and conclude peace treaties with them So, at the present day, hearsay evidence about the amounts of distances is more accurate and trustworthy For in the book (called the *Geography*), we often find places which are located to the east of others, but actually they are westerly, and vice versa "[4]

These utterences of al-Bīrūnī are so interestingly reminiscent of the statements of Barthold in whose estimation the main significance of the rise of Islam in the history of civilisation is the fact that thereby a realm came into being in which the cultural cooperation of a considerable part of mankind was possible [5]

There should be no doubt furthermore that, being a scientific researcher himself, the enrichment of the scientific legacy of the past was foremost in al-Bīrūnī's mind This was his aim in all his personal scientific work, and he was moreover much preoccupied with determinations of priorities in a variety of important and interesting discoveries and with exact appraisals and evaluation in connection with the nature and extent of various scientific activities and accomplishments

Indeed, al-Bīrūnī constitutes a very important source for the history of science His detailed list, accompanied by trenchant remarks and comments, of the works of Abū Bakr Muḥammad ibn Zakarīyā' al-Rāzī, one of the most original and profund among the scientists and thinkers of Islam, constitutes an invaluable document on the subject Other examples of a similar nature too many be found in the works of al-Bīrūnī in no inconsiderable number

Naṣir al-Dīn al-Tūsī, who was interested in the history of trigonometry, relies on and draws upon al-Bīrūnī, in his *Kitāb al-Shakl al-Qatta'*, when attributing the discovery of the law of tangents to Abū al-Wafā al-Būzjānī,[6] and that of the law of sines in its most general form to Prince Abū Naṣr Manṣūr ibn 'Alī ibn 'Irāq, al-Bīrūnī's teacher [7] In fact, material from al-Bīrūnī himself too has come down to us on this latter subject

I may dwell on certain other specific examples of a slightly different nature, in order to illustrate al-Bīrūnī's interest in the progress of scientific knowledge and work I shall first deal with the astronomical observatory and al-Ma'mūn's patronage and activities connected with astronomical work

Medieval Islam occupies an important place in the emergence and development of institutions of science and learning such as the university, the hospital, the library, and the observatory which form an integral part of our modern soeity and civilisation In particular, the observatory as an organized and specialized scientific institution was born in Islam, where it also underwent its evolution and development to a considerable extent The first Islamic observatories were created by al-Ma'mūn, Abbasid caliph from 813 to 833 They were the Shammasiyah Observatory of Baghdad and the Qaṣiyūn Observatory of Damascus

We know that the observatory underwent a gradual development during the Middle Ages of Islam, from its beginning in al-Ma'mūn's time, through the Baghdad Observatory of the Buwayhid Sharaf allah and the Isfahān Observatory built by the Saljuq king Malikshāh, to the Maragha Observatory founded by the Ilakhanid ruler Hulagū, the Samarqand Observatory of Ulugh Bey, and the Istanbul Observatory founded in the sixteenth century by the Ottoman King Murad III in about the period when Tycho Brahe was engaged in carrying out his famed astronomical observations The number of major Islamic observatories is rather limited and adds up, all told, to less than ten How did it come about then that al-Ma'mūn founded two observatories? The answer hinges partly upon the crucial additional question as to whether the Shammasiyah and the Qaṣiyūn Observatories operated simultaneously or not

Another important question concerns the nature of the activity that took place in this new-born institution Did al-Ma'mūn and his fellow-scientists conceive the observatory primarily as a research institution, or, rather, as an institution of science and learning of a more limited and less pretentious scope meant to deal, more specifically, with e g such utilitarian matters as the preparation of astronomical tables or with bringing them up to date? From this standpoint, it is important to have as clear an idea as possible of the mutual relationship between the Shammasiyah and the Qaṣiyūn Observatories, on the one hand, and the Bayt al-Hikmah and the repeated geodetic expeditions organized by al-Ma'mūn, on the other

It is only with the help of al-Bīrūnī that we can find reasonably clear factual and concrete answers to these questions Sources with fragmentary data concerning these institutions and undertaking abounded, but it was impossible to fit these incidental references into a satisfactory and interrelated picture It was the information gleaned from al-Bīrūnī, and especially from his Taḥdīd, that have supplied us with the missing links

We learn from al-Bīrūnī that the creation of the Qaṣiyūn Observatory represented some kind of an improvement or evolution in the nascent institution, the observatory, based on the experience gained through the work done at

Shammasiyah The Qaṣiyūn Observatory was supplied at least with improved and superior instruments as compared with those of the Shammasiyah Again, information given by al-Bīrūnī, in conjunction with that obtainable from Habash Al-Hāsib and Ibn Yūnus, indicates that the staff of the Qasiyūn Observatory was made up largely of the scientists working in the Shammasiyah Observatory and that therefore the two institutions were not, strictly speaking, two independent observatories functioning simultaneously, but that the foundation of the Qaṣiyūn Observatory was at the cost of the relaxation or interruption of work at Shammasiyah [8]

Knowledge derived from al-Bīrūnī indicates, on the other hand, that at least the geodetic measurements of Sinjar in particular were connected with the translation of Ptolemy's *Almagest* carried out at the Bayt al-Ḥikmah rather than with al-Ma'mūn's Baghdad or Damascus Observatories [9] We know, likewise, thanks to al-Bīrūnī, that the differences of latitude and longitude between Baghdad and Mecca were determined through the initiative of al-Ma'mūn, the difference of longitude having been found with the help of observations of lunar eclipses made simultaneously in both places The purpose of this work was of course to make it possible to use Baghdad as a convenient auxiliary point of reference in establishing the directions of *qiblah* for different cities Al-Ma'mūn had also the distance between Baghdad and Mecca measured by surveyors [10]

From al-Bīrūnī we learn, moreover, that the method of measuring the radius of the earth on the basis of the determination of the angle of depression of the horizon when viewed from a place of high latitude, a method used by himself in India, was utilized earlier by Sanad ibn 'Alī and that apparently al-Ma'mūn himself knew of this method [11] Al-Bīrūnī also constitutes our most detailed as well as informative and intelligent source on the important and otherwise somewhat hazy topic of *al-suds al-Fakhrī*, the huge instrument in the form of a sixty degree meridian arc constructed by al-Khujandī under the patronage of the Buwayhid ruler Fakhr al-Dawalah (976-997) [12]

Of course, al-Bīrūnī's *Chronology of Ancient Nations* and his *India* constitute, in particular, veritable mines of information for the history of science But I have limited myself here to singling out for consideration certain examples wherein al-Bīrūnī helps us ascertain individual and concrete situations and trace or follow up steps of progress in scientific work and knowledge in the fields of trigonometry, astronomy, and mathematical geography in special, and I have preferred to choose examples which serve to illustrate his conception of the cumulative process with which exact objective knowledge grows

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AL-BĪRŪNĪ AS A MATHEMATICIAN

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IN this paper we are going to consider Abū Raiḥān Muḥammad ibn Aḥmad al-Bīrūnī as a mathematician The term mathematician applies to any person who is a serious student of mathematics That al-Bīrūnī was a serious student of mathematics is evident from his books on mathematics and astronomy Even his book *Tā'rikh al-Hind* contains an account of the new mathematics that he came across in India

When al-Bīrūnī entered India, he probably had a good knowledge of Indian mathematics, astronomy and chronology, acquired by the study of Brahmagupta and his Arabian editors In India, al-Bīrūnī recommenced his study of Indian astronomy, this time not from translations, but from Sanskrit originals Assisted by learned pandits, he tried to translate them He tried to check his pandits by whatever Sanskrit he had contrived to learn He also tested the data of the Indian astronomers by calculations To al-Bīrūnī the Hindus were excellent philosophers, good mathematicians and astronomers

To al-Bīrūnī we owe the best mediaeval account of Hindu numerals Before the time of our Holy Prophet (may peace be on him) the Arabs had no numerals Numbers were written out in words Later, the numerous computations connected with financial administration over the conquered lands made a short symbolism indispensable In some localities, the numerals of the more civilized conquered nations were used for a time Thus, in Syria, the Greek notation was retained, in Egypt, the Coptic The Diwani-numerals, found in an Arabic-Persian dictionary, are supposed to be such abbreviations Gradually it became the practice to employ the 28 Arabic letters of the alphabet for numerals, in analogy to the Greek system This notation was in turn superseded by the Hindu notation, which quite early was adopted by merchants, and also by writers on arithmetic Its superiority was generally recognized, except in astronomy, where the alphabetic notation continued to be used As regards the form of the so-called Arabic numerals, the statement of al-Bīrūnī, who spent many years in India, is of interest He says that the shape of the numerals, as also of

the letters in India, differed in different localities, and that the Arabs selected from various forms the most suitable There was among people much difference in the use of symbols, especially those for 5, 6, 7, and 8 The symbols used by the Arabs can be traced back to the tenth century But most surprising is the fact that symbols of both the East and of the West Arabs deviate so extraordinarily from the Hindu Devanagri numerals of today, and that they resemble much more closely the apices of the Roman writer Boethius This strange similarlity on the one hand and dissimilarity, on the other, is difficult to explain The most plausible theory is the one of Woepcke (1) that about the second century after Christ, before the zero had been invented, the Indian numerals were brought to Alexandria, whence they spread to Rome and also to West Africa, (2) that in the eighth century, after the notation in India had been already much modified and perfected by the invention of the zero, the Arabs at Baghdad got it from the Hindus, (3) that the Arabs of the West borrowed the zero from those in the East, but retained the old forms of the nine numerals, (4) the old forms were remembered by the West Arabs to be of Indian origin, and were hence called Gubar-numerals (5) that, since the eighth century, the numerals in India underwent further changes, and assumed the greatly modified forms of the modern Devanagri numerals This is rather a bold theory, but whether true or not, it explains better than any other yet propounded, the relation between the apices, the Gubar, the East Arabic, and Devanagri numerals

Al-Bīrūnī composed an astronomical encyclopaedia and a general treatise on mathematics, astronomy and astrology He was deterred neither by formidable computations nor by the most difficult geometrical problems of his time, those called after him albirunic problems He discussed the problems of summation of a geometric progression, trisection of the angle and other problems which cannot be solved with ruler and compass alone He gave a method for accurate determination of latitudes and longitudes We are also certain that al-Bilrūnī knew the law of sines in trigonometry

I regret that due to non-availability of his original work in mathematics, it is not possible to give details of the manner in which he solved different problems. But we give below an appreciation of his work by George Sarton, given in his book, "*Introduction to History of Science*", page 693

"It is because of al-Bīrūnī and Ibn Sīnā that the first half of eleventh century was one of great excellence and distinction in the history of science These two men, who, by the way knew one another, were extremely different, al-Bīrūnī represents the more adventurous and critical spirit, Ibn Sina the synthetic spirit, al-Bīrūnī was more of a discoverer and in that respect he came nearer to the modern scientific ideal, Ibn Sīnā was essentially an organizer, an encyclopaedist, a philosopher Both, even the latter, were primarily men of science, and it would be difficult to choose between them but for the accidental fact that al-Bīrūnī's life covered more fully the present period and thus may be said

to represent it more completely Ibn Sīnā was only 20 at the beginning of the century, and his life was untimely cut short in 1037 Al-Bīrūnī's first important work appeared about the year 1000 and he lived until 1048 Thus his time of activity and the first half of the eleventh century are identical period, and we are fully justified (more fully so than in almost every other case) in calling it the time of al-Bīrūnī"

"Al-Bīrūnī appeals to the scientific mind because of his relative freedom from prejudice and of his intellectual curiosity and courage For example, he was the first Muslim to make a deep study of Hindu philosophy and became the most important link between the two great provinces of mankind, India and Islam "

"He was a stern judge both of himself and of others Himself perfectly sincere, it was sincerity which he demanded from others Whenever he did not understand a subject, or only knew a part of it, he would at once tell the reader so, either asking the reader's pardon for his ignorance or promising, though a man of fifty-eight years, to continue his labours and to publish their results in time, as though he were acting under a moral responsibility to the public He always sharply drew the limits of his knowledge, and although he had only a smattering of the metrical system of the Hindus, he communicated whatever little he knew "

"Judging al-Bīrūnī in relation to his predecessors we come to the conclusion that his work formed a most signal progress His description of Hindu philosophy was probably unparalled His system of chronology and astronomy was more complete and accurate than had ever before been given "

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2 Sarton, George — *Introduction to History of Science*

RESOLUTIONS & RECOMMENDATIONS

ON the occasion of the International Congress held in Pakistan to commemorate the one thousandth anniversary of Abu Raihan Muhammad ibn Ahmad al-Biruni resolutions were passed and recommendations were made by the national and international delegates to the Congress. They are reproduced below

RECOMMENDATION NO 1

INSTITUTE OF HISTORY AND PHILOSOPHY OF ISLAMIC SCIENCE

Preamble

It must be quite evident at a superficial glance even, that the subject of the history of medicine and science, and the relationship of both with culture is one of the darkest aspects of human knowledge and even to this day we have not been able to determine many at first in innovation, invention improvisation, and serendipity

If this is true of the West, the truer it would be of the Muslim countries, where it is only of late that the realization that we have fritterad away centuries without an objective approach is dawning If we know our past, and are conscious of it, we would not like Augustus Caesar cry in despair "Varus, Varus, General Varus, give me my legions back!"

General Considerations

The success of any organization depends upon how it is administered, whether the purpose or the *raison d'etre* behind it has any loftiness of purpose and end-use, and whether the programme is translatable into reality

The scope of coverage by the kind of the Institute being planned is very wide Joseph Needhem, *History of Science and Technology in China* has shown how ambitious even an approach with a limited objective can be In a country like Pakistan, for example, with lesser resources, the subdivisions of the Institute might be in the following order (a) politico-social history, (b) cultural and physical anthropology, (c) history and philosophy of medicine, early chemistry, epistemology, (d) documentation, (e) history of technology, e g , in military hardware, etc

A national organization dealing with a subject having such a broad scope should have at its disposal international cooperation For example, the Hamdard

National Foundation has found that with advance planning many of the handicaps faced earlier, e.g, in the Millenary of Ibn al-Haitham, were removed This is attested by the success we have had with the present Millenary of Al-Biruni. This because we have not resorted to "dispersed" or "international" nationalism, but sought the kind succour of everyone who would assist. With the nucleus already at the disposal of the Foundation, it is possible to go ahead with this project on a note of high expectation

Organization and Administration

1 The Institute is proposed to be established in Karachi, which is the major educational, financial and administrative centre of Pakistan

2 The Institute shall have chapters or subgroups within the other major centres and shall aim at the establishment of mutual aid rather than degenerative competition

3. The organization shall vest in one individual who shall be supported by a *small and* manageable group in charge, equivalent to an Executive Council/Governing Body To begin with this group would comprise five or six people who would be ready to devote time to the administration of this Institute, and representation would rotate say every alternate year

4 This would mean the drafting of the constitution of the Institute under the Societies' Act and election or nomination—possibly the former—with a Life-President who would be the sponsor of the Institute

5 The bye-laws will be such as to identify the purposes of the Institute and define the procedures

6 Every effort will be made to reduce the bureaucratic load and procedures and to streamline the operations

7 Many of the visualized plans are not just meant to be investments into projects that do not promise economic return This Foundation has found that its publications could have a market, if we could so orient our efforts

8 Membership and participation would be carefully watched and reasonably planned well in advance

a The group should not become the exclusive prerogative of a few, forming as it were, a sort of club going by the status or the fame of the persons rather than by their work or usefulness to the Institute Others, of lesser station but abler timbre, should be provided with an opportunity to serve

b The major criteria should be the interest shown by the individual, competence in his own fields, and intention.

Payment of dues by *all* is a good control requirement

Objectives

1 The Institute will be national, but even different nations may have a broadly similar culture The examples of Central and Latin America and Arabian lands, both in North Africa and West Asia, would serve. Similarly Arabs, Persians, Turks and many African and South-East Asian countries show the common denominator of Islam

A historical group would have thus three concerns (a) national or socio-political, (b) racial or genetic, and (c) cultural The cultural heritage of any country is a complex affair, and several factors coalesce into the making of a nation, however homogeneous it may be, even among the people as homogeneous as the Danes or the Japanese Neither should be neglected at the cost of the other

2 A national society should primarily be interested in identifying the characteristics and contribution of their own society (cultural, racial, national) This requires the study of the nation's people, the forces that have impinged on that culture and made it what it is today, the major representatives of the culture who helped in building that culture, establishing its attributes and making contributions towards it

3 A national society cannot operate in an irregular fashion How does one nation react to a challenge and why are the responses different? What are the results of the impacts of different cultures on a nation? How is it that in one country technology is at a premium and in another at a discount? Such questions will have to be taken up and answered objectively on the basis of precise documentation

Even otherwise also, coming home to Pakistan, the history of this region cannot be understood without reference to Idrisi and Ibn Batuta (Arabic), Huen-Tsiang (China), *Tuzk-i-Babari* (Turkish) and so on It is thus essential to reorganise indebtedness, similarities and dissimilarities and the causative factors for each Perspective which is essential to the historian is all the more essential to the historian of science

Programme

The programme of the Institute should be characterised by regularity and continuity both for administrative and academic purposes Unscheduled, haphazard, and irregular meetings will not—for the simple reason that advance commitment has to be made well in advance both by the participants and the sponsors—sustain societies or interest in societies

Business which demands the attention of the whole society and not just the Executive body can be conducted through the convention of a general body

meeting in one meeting a year or two at the most (policy, finances, membership, programme approvals, etc)

The academic (scholarly) meeting and projects, which justify the existence of the Institute should be held with a frequency that would sustain interest but not too often. Three or four years duration with one major symposium or special lecture would be in order In a small community where there are not many competing interests monthly meetings might be possible but programming is difficult at that rate

Programmes must accomplish something beyond merely giving individuals the opportunity to speak A years programme should have an objective and it is desirable that the Steering Committee should think two-three years in advance

There is little or no purpose in envisaging a society of this kind until a good number of documents and reference literature is available, and books on the subject are available through the operation of a round-the-clock library service

While international meetings should be aimed at no more frequently than once in four or five years, some of the major annual meetings could have a confined international purpose—such as a consideration of the Chinese—West Asia (Arabic or Islamic) cultural relationships through the Mongolians, the Mughal culture in India, the history of dams in Iran, Arab lands, and Spain during the Moorish times, a study of the geography of the trade routes in West Asia, Middle East, and South-East Asia during the pre-Medieval and Medieval times, etc

There is no more fruitful ground for further research in history As examples, one may cite the following

1 There is a magnificent array of religions—religious influences of a unique variety The Nestorians, Manichaeans, and others form a bridge to the Western civilization

2 There are multiple subcultures and histories—Sumero-Akkadian, Babylonian, Assyrian, Hittite, Syrian, Persian, Arabic, Turkish, Mongolian, and still others. The Hebrew culture bridges Western and West Asian cultures

3 There are then further numerous connexions with the three other cultures· Western, Eastern, Southern (Hindu) and West and East Africa

Even to think upon it inspires even in the mediocre scholar interest and enthusiasm The problem will not be of lack but one of too much potentiality

RECOMMENDATION NO 2

AL-BIRUNI ROAD IN PESHAWAR

That the International Congress of al-Biruni held at Peshawar requests the Municipal Committee of Peshawar to name one road in Peshawar after the distinguished Muslim scholar—scientist, Abu Raihan Muhammad Ibn Ahmad al-Biruni

RECOMMENDATION NO 3

AL-BIRUNI GOLD MEDALS

That "al-Biruni Gold Medals" be established at the Universities of Karachi, Peshawar, Islamabad and Punjab These medals be financed by the Hamdard National Foundation, Pakistan, and be awarded to the student obtaining highest marks for thesis/dissertation in the Masters' Degree Course in the Faculty of Social Sciences

RECOMMENDATION NO 4

COMMITTEE FOR THE SCIENTIFIC TERMS OF AL-BIRUNI

Al-Biruni was a scholar who contributed to Islamic culture in the field of mathematics, astronomy, history, pharmacology, geology, physics, mineralogy and astrology He learned a great deal in these fields from Greek, Indian and Persian culture He mastered the Arabic language and was able to find and derive convenient technical terms in the various fields of his study Since all these technical terms are found in al-Biruni's books, and since Muslim science and arts are in need of them, it is necessary that they should be listed from each of his books to be compiled into one dictionary This will be of great benefit to us in the study of the Islamic History of Science Recommended that Hamdard National Foundation, Pakistan should form a Committee from the specialist-scholars on al-Biruni all over the world It should be called the Committee for the Scientific Terms of al-Biruni Each Specialist-Scholar should list the terms of al-Biruni in his field of study and finally these terms should be collected and published in a Dictionary in Arabic and other languages

RECOMMENDATION NO 5

AL-BIRUNI CHAIR IN UNIVERSITY OF THE PUNJAB

That in recognition of the incomparable contribution made by Abu Raihan Muhammad ibn Ahmad al-Biruni and further with the aim of making his works accessible to future generations, an "Al-Biruni Chair" be established in the Department of History in the University of the Punjab

اذ لا تضاد في الحركات المستديرة ولا خلاف في جهاتها كان التمويه السفسطة ظاهرا من لوازم هذا القول اذ لا يمكن ان يتوهم للشيء حركتان طبيعيتان احدهما الى المشرق والاخرى الى المغرب " نفس المصدر "

ويستند ابن سينا في رده على اعتراض البيروني الى ان الحركات الدائرية لا متناهية ومن ثم فهي متخالفة وليست متضادة اذ التضاد يتطلب التناهي فيقول مخاطبا البيروني ـــ

" اما انها تك ان حركة الافلاك والكواكب متضادة فليست كذلك وانما هي متخالفة فقط لان الحركات المتضادة هي المتضادة في الجهات والنهايات ...... واما جهات ما بين الحركتين المستديرتين ونهاياتها فهي بالوضع من غير فصل لا بالطبع فانه ليس بالطبع لحركات الفلك المستديرة نهاية فاذا ليست متضادة فليست الحركتان الدوريتان المتخالفتان بمتضادتين وذلك ما اردنا ان نبينه " (نفس المصدر)

وهذا الرد السينوي لم يقنع البيروني ولا من جاء بعده حيث ان المتكلمين يردون اختلاف هذه الحركات الى الارادة القديمة التي ميزت الحركة المشرقية من المغربية فالارادة هي السبب في تحديد الجهات والنهايات والاوقات ويسمي الغزالي برهان التضاد هذا ببرهان الخليل (عليه السلام) فيما ادعى نمرود الالوهية اعترضه الخليل (عليه السلام) قائلا " ان الله يأتي بالشمس من المشرق فأت بها من المغرب " وهنا يرى الغزالي كبقية المتكلمين ان تغير الحركات المشرقية من المغربية يحتاج الى سبب خارج الحركة نفسها وهذا ما يتناقض مع مذهب ابن سينا الذي يرد السبب الى الحركة الدائرية نفسها .

وقد لعبت اشكالات فكرتي التضاد والتشابه والتضاد دورا رئيسيا في محاولة وضع النظريات لتحديد مبدأ السببية سواء كان ذلك في الفلسفة الاسلامية او الفلسفة الاوربية الحديثة فها هو ابن سينا يرد مبدأ السببية الى مبدأ التناقض والغزالي يبرهن على خطأ هذا الفرض وها هو هيوم (Hume) يأخذ بتصور الغزالي ويعتقد بان العلاقة بين العلة والمعلول لا تقوم على الضرورة المنطقية وبعد كانط (Kant) يحاول وضع تحديد لمبدأ السببية في مجال العلوم الطبيعية دون الميتافيزيقيا ولم تكن محاولة كانط Kant اول وآخر نظرية لتحديد مبدأ السببية اذ يمكن القول بان البحث في هذا الميدان " بحر لا ساحل له "

البيروني — نفسه — يؤدي الى الاعتقاد بان جسم الفلك لا خفيف ولا ثقيل ويسوق ابن سينا براهينه على عدم الخفة والثقل للفلك في صورة اقيسة حملية وشرطية . والجدير بالذكر ان الغزالي برهن في كتابه " تهافت الفلاسفة " ومن بعده كانط Kant في كتابه " نقد العقل المحض Kritik der reinen Verunft " على ان مثل هذه الاقيسة في ميدان الميتافيزيقا تؤدي الى النقيضين ، وفكرة تشابه الاجزاء للفلك هي النقطة التي يشير بها الغزالي في المسألة الاولى من كتاب تهافت الفلاسفة " معترضا بذلك على السبب الكافي عند ابن سينا لتحديد القطب الشمالي والجنوبي للفلك اذ مامن نقطة على الفلك المتشابه الاجزاء الا ويمكن ان تكون احد القطبين واذا كان ابن سينا كما في كتابه " النجاة " يقول بان العالم لا متناه في الزمان لان الاوقات جميعها متساوية ولا يوجد سبب كاف يؤدي الى خلق العالم زمانيا فان الغزالي يرى ان مذهب ابن سينا في لا تناهي الزمان يؤدي الى القول بلا تناهي العالم في المكان " وتساوي الجهات كتساوي الاوقات " اما تحديد نقطتي القطب الشمالي والجنوبي من بين النقاط المتشابهة فانه يشترط وجود سبب ما يميز الشئ عن مثله وهذا يؤدي الى القول بتحديد العالم في الزمان اي انه مذهب ابن سينا في السبب الكافي يؤدي حسب تحليل الغزالي الى القول بان العالم متناه او لا متناه في الزمان والمكان وقد اخذ نيوتن Newton بالنتيجة الاولى وهي تناهي العالم في الزمان والمكان اما ليبنتز Leibnitz فقد اخذ بالنتيجة التالية وهي حيث ان الاوقات متساوية الاماكن متساوية لا يوجد سبب كاف الى القول بتناهي العالم في الزمان او المكان وقد ادرك كانط Kant التكافؤ بين النتيجتين ومن ثم نجد فكرة تساوي الجهات والاوقات هي التي تكون الحجر الاساسي في نقد المسألة الاولى من كتاب " تهافت الفلاسفة للغزالي

واذا ماعدنا الى البيروني فاننا نجده في الجزء الثاني من السؤال السالف الذكر يعترض على الحركة الدائرية بانها ليست الحركة الطبيعية بدليل ان الحركات الدائرية للافلاك والكواكب متضادة اذ ان بعضها تتجه نحو المشرق وتتجه بعضها نحو المغرب فالفلك الاقصى مثلا حسب التصور التقليدي يتحرك في اتجاه معاكس لاتجاه الفلك الذي تحته وبعد ان يسلم البيروني بان حركة الكوكب نحو المشرق طبيعية اما حركتها نحو المغرب فهي حركة مضادة لحركتها نحو المشرق ومن ثم فهي حركة قسرية وليست طبيعية يصوغ البيروني اعتراضه هذا قائلا :ـــ

" واما حركته (اي حركة الفلك الاقصى) المستديرة فقد يمكن ان لا تكون له طبيعية وذلك كحركات الكواكب الطبيعية الى المشرق والحركة العرضية اللازمة لها الى المغرب فان قيل ان تلك ليست بعرضية

بالتكاثف من ذرات الملأ و الخلأ يدحض برهان ابن سينا على تناهي المكان .

اما البيروني فانه في الجزء الاول من السؤال الاول الذي يوجهه لابن سينا مع مجموعة من الاسئلة الاخرى يعترض فيه على قول ارسطو بان جسم الفلك لا هو خفيف و لا هو ثقيل لان الخفة و الثقل لا يؤثران على الحركة الدائرية للفلك ما دامت اجزاء الفلك متشابهة فيقول مخاطبا ابن سينا :

" سألت اسعدك الله ـ لم اوجب ارسطوطاليس للفلك عدم الخفة و الثقل لعدم وجود حركة له من المركز او اليه ؟ فانا نستطيع ان نتوهم فيه انه من اثقل الاجسام توهما لا ايجابا لان ذلك لا يوجب ان يكون له حركة الى المركز من اجل ان حكم اجزائه متشابهة

(الاسئلة و الاجوبة ـ ابوريحان البيروني و ابن سينا ـ تحقيق مهدي محقق ص2)

و فكرة تشابه اجزاء الفلك التي يمكن ان تكون ثقيلة او خفيفة توازي فكرة تكاثف اجزاء الفلك عند الرازي المكونة من الذرات الخفيفة و الثقيلة و لكن البيروني يختلف مع الرازي في ذلك اذ ان ما يعنيه البيروني بالاجزاء المتشابهة الثقيلة للفلك ليست ذرات جسمانية منفصلة كما عند الرازي و انما يفترض انها اجزاء متصلة فيقول " اذا كان كل جزء من اجزائه متحركا بالطبع الى كز ثم كانت متصلة لم يوجب الا الوقوف بحيال المركز "

(نفس المصدر)

كما يمضي البيروني فانه يتبادر الى الذهن و بانه يأخذ بنظرية الخلأ للرازي عندما يتصور ان جرم الفلك من اخف الاجسام فيقول " و كذلك نستطيع ان نتوهم انه (اي جرم الفلك) من اخفها و لا يوجب ذلك حركة من المركز لاجل الانخراق و الاحتراق و وجود الخلأ خارجه و اذا تقرر عندنا و صح عدم الخلأ خارج الفلك كان الفلك و ان كان مثلاً ثقيلا كانه محصور ممتنع (نفس المصدر)

و هكذا نجد البيروني يتميز بتفكيره الخاص في نقده لارسطو فهو لا يأخذ بمذهب الرازي القائل بان المكان المطلق لا متناهٍ و لا يسلم بالمذهب الذري بل نجده يتفق مع ارسطو و ابن سينا في القول بتناهي المكان و يفترض ان اجزاء الفلك متصلة و لكنه يختلف مع ارسطو في اعتقاده بان شرط الحركة الدائرية ان لا يكون الفلك خفيفا او ثقيلا و يرى البيروني ان تشابه اجزاء الفلك يكفي لان يتحرك حركة دائرية .

و يحاول ابن سينا في رده على البيروني ان يوضح ان القول بتناهي المكان ـ و هذا ما يسلم به

حدثت في ذات الله و يرد الاشاعرة حدوث العالم الى الارادة القديمة التي من حسب تعريفهم " صفة من شأنها تمييز الشيء عن مثله " اما فلاسفة الاسلام بالمعنى التقليدي فقد ادعى اعظمهم أن العالم حدث لذات الله في الازل و يسمي ابن سينا هذا النوع من الحدوث بالحدوث الذاتي (Inceptio Temporalis) مقابل الحدوث الزماني (Inceptio essentialis) و يعترض ابن سينا على قوله هذا بان الاوقات متساوية فلا يوجد بالنسبة لواجب الوجود " وقت اولى من وقت quod non lora potioralis" و لايعترف بتحديد الاشاعرة للارادة القديمة التي تميز و تخاص مثله بمحض الذات و تساوي الاوقات بالنسبة لواجب الوجود من الجهة التي يستند اليها ابن سينا في قوله بحدوث العالم في الازل فواجب الوجود بذاته واجب الوجود من جميع جهاته Necesse esse omnibus modis suis و من ثم يفيض منه الوجود في الازل دون تعطيل او تمييز لوقت دون آخر فالاوقات جميعها متشابهة . و خلاصة القول هو ان المتكلمين و على راسهم الاشاعرة قد لجأوا الى الارادة كسبب لتمييز الاوقات و خصائص الاشياء _ اما الفلاسفة و على راسهم ابن سينا فقد ربطوا السبب بحركة ارسطو الدائرية فالحركة الدائرية ليس لها بداية او نهاية و من ثم فهي ازلية ابدية و يتحدد الزمان من حيث انه ازلي على انه مقدار الحركة الدائرية و تحدد حركة الفلك الاقصى تناهي العالم في المكان لانه كما يصرح ابن سينا في " عيون الحكمة " بانه لو كان جسما له بعد مكاني لا متناه فلا يمكن ان تكون جملته حركة دائرية و تحدد الحركة الدائرية ايضا القطب الشمالي و الجنوبي و بقية الجهات و ما الى ذلك من صفات الاشياء المكانية و كذلك تحدد فصول السنة و الليل و النهار و ما الى ذلك من اختلاف الاوقات الزمنية

و الحركة الدائرية للفلك حركة طبيعية و ليست قسرية و هي تشترط تشابه أجزاء الفلك و عدم الخفة و الثقل لجرمه و ذلك لكي لا يكون لهذا الفلك حركة غير طبيعية نحو فوق او تحت او نحو المركز و من المركز و من المركز و قد استطاع البيروني انه يعتقد كون الحركة الدائرية كحركة طبيعية من خلال فكرة التشابه لاجزاء الفلك و التضاد في الحركات الدائرية و قد سبق البيروني الطبيب الفيلسوف محمد بن زكريا الرازي في نقده لحركة ارسطو الدائرية فقد استطاع الرازي ان يطرح تصورا مغايرا لتصور ارسطو اذ راى أن الحركة الدائرية للفلك لا تشترط تناهي المكان بل هي تتم في مكان محدود من المكان المطلق اللا متناهي معترضا بذلك ان جرم الفلك يتكون من ذرات متكافئة في الخفة و الثقل هي الخلاء و الملاء و هذا التكافؤ بين الذرات هو الذي يجعل الحركة الدائرية الحركة الطبيعية للفلك و بهذه النظرية في التكافؤ بين الذرات الخفيفة و الثقيلة لم يعد عدم الخفة و الثقل شرط الحركة الدائرية و كذلك نقد الرازي باختلاف المذاهب الذري و قوله

دور البيروني في تحديد مبدأ السبب الكافي
(التشابـــــــه و التضـــــــاد)

بقلم الدكتور محمد يحيى الطاهر عريبي
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يمكن القول اجمالا بأن تطور الفكر البشري يقوم على مبدأين رئيسيين هما مبدأ التناقض الذي يلعب دورا رئيسيا في تطور العلوم الرياضية ، و مبدأ السبب الكافي الذي يتمتع ببعض الاهمية في تطور العلوم الطبيعية _ (1)

و قد ارتبط مبدأ السبب الكافي في تاريخ الفلسفة بالمفكر الالماني ليبنتز (G Leibnitz) الا أنّ التقصي في بحث التطور التاريخي للافكار يثبت خطأ ذلك حيث انّ الصراع حول هذا المبدأ بين ليبنتز (Leibnitz) و نيوتن (Newton) كما في الرسائل المتبادلة بين ليبنتز و كلارك (Clarke) يمثل خلاصة الصراع الذي دارت رحاه في الفلسفة الاسلامية و البيروني باعتباره مفكرا بين كبار مفكري الاســـلام ساهم في هذا الصراع من جوانب متعددة و لعل اوضح صورة لهذا الصراع تتمثل في أسئلة البيروني الموجهة الى ابن سينا و التي تثير شكوكا حول بعض المسائل الواردة في كتاب السماء (De Caelo) لارسطو و في هذه المقالة من التي قمنا باعداد ها أثناء انعقاد هذا المؤتمر ، و حيث ان المصادر اللازمة له تتوفر لنا بعد ، نريد ان نحدد البحث من خلال نقطتين هما نقطتين اثارهما البيروني في السؤال الاول من الاسئلة التي وجهها لابن سينا و هما " التشابه و التضاد "

اما الصيغة الرئيسية لمبدأ السبب كما يطلب استعمال الغزالي لها ، و من بعده ليبنتز هي " كل حادث فله سبب " و يعني مبدأ السبب ان كل مايحدث انما يحدث في مكان معين ، و زمن محدد و كل ما يحدث انما يحدث لسبب كان يبرر حدوثه فيمكننا مثلا ان نتساءل لماذا انعقد المؤتمر الالفي للبيروني هذا العام و لم يحدث قبله او بعده ؟ و لم حدث مثل هذا المؤتمر في افغانستان و ايران و باكستان و لم يحدث مثله في البلاد العربية ؟ و قد ادّى السؤال عن السبب بمفكري الاسلام الى السؤال عن سبب حدوث العالم. لم حدث هذا العالم بالذات و لم يحدث غيره و بعبارة اخرى ، لم حدث بالحجم الذي هو عليه و الصورة التي هو عليها و لم يكن على العكس من ذلك ، و لم حدث في الوقت الذي حدث فيه و لم يحدث قبله او بعده ـــ • • • • و قد تعددت اجوبة و نظريات المتكلمين على مثل هذا الاسئلة فالمعتزلة يرون أنّ العالم حدث في الوقت الذي حدث فيه و لم يحدث قبله او بعده ، لا نه اصلح وقت لحدوثه و قد حدث بارادة

قواعدی برای دانستن حساب خانه‌های شطرنج برای دانستن دو برابر شدن عدد خانه‌های شطرنج دو قضیه زیر را باید دانست

قضیه اول ــ هرگاه عددی را که در یکی از خانه‌های شطرنج است مجذور کنیم فاصله این مجذور از عدد این خانه مساوی است با فاصله آن از خانه اول

مثلا هرگاه بخواهیم مجذور عددی را که در خانه پنجم است بدست آوریم عدد این خانه را که ۱۶ باشد مربع می‌کنیم ۲۵۶ می‌شود که عدد نهمین خانه است و دوری خانه نهم از خانه پنجم مانند دوری خانه پنجم از خانه اول است

قضیه دوم ــ عدد هر خانه مساویست با مجموع اعداد خانه‌های پیشین منهای یك واحد

مثلا هر وقت عدد خانه ششم را که ۳۲ می‌باشد یکی از آن کم کنیم با مجموع اعداد خانه‌های پیشین یعنی ۱، ۲، ۴، ۸، ۱۶ مساوی می‌گردد

معنای $۱۶^۸$ این است که عدد خانه سی وسوم را در خود ضرب کنیم تا عدد خانه شصت و پنجم بدست آید و چون یك واحد از آن کم کنیم مجموع اعداد در خانه شصت و چهارم بدست می‌آید

توضیح اینکه اگر عدد خانه پنجم را که ۱۶ می‌باشد در خود ضرب کنیم عدد خانه نهم بدست می‌آید و اگر عدد این خانه را در خود ضرب کنیم عدد خانه هفدهم بدست می‌آید و چون این عدد در خود ضرب شود عدد خانه سی و سوم بدست می‌آید که از ضرب آن در خود، عدد خانه شصت و پنجم بدست آمده

با توضیح ساده‌ی این دو قضیه و صفحه‌های بعدی چنین دانسته می‌شود که بدانیم عدد هر خانه‌ی شطرنج برابر است با ۲ بتوان عدد آن خانه منهای یك پس عدد خانه پنجم برابر است با $۱۶ = ۲^۴$ و چون این عدد مجذور شود $۲^۸$ می‌شود که عدد خانه نهم است

خانه نهم	$(۱۶^۲)$
خانه هفدهم	$(۱۶^۲)^۲ = ۱۶^۴$
خانه سی وسوم	$(۱۶^۴)^۲ = ۱۶^۸$
خانه شصت و پنجم	$(۱۶^۸)^۲ = ۱۶^{۱۶}$
که عبارتست از	$۲^{۶۴} \times ۲^{۳۲} \times ۲^{۳۲} \times ۲$

این بیان از مترجم است

همچنین طبری و بیرونی و حمزه اصفهانی به تقلید از زردشتیان مدت پادشاهی اشکانیان را — دویست و شصت و شش سال دانسته‌اند درحالیکه اهل کتاب بنابر قول طبری پانصد و بیست و سه سال میدانستند و بیرونی از کتاب شاپورگان مانی که مانی برای شاپور نگاشته و خواندن آنچه مانی توانست تاریخ دین جلوس اردشیر را بدست آورد چون تاریخ اسکندر رومی روشن بود مدت سلطنت اشکانیان نیز بدست آمد که پانصد و سی و هفت سال است.

(از تواریخ معلوم است که طول این مدت یعنی از فوت اسکندر تا پدید آمدن اردشیر بابکان پانصد و چهل و هشت سال است. ((نقل از ایران باستان)) دوره سلطنت سلوکیها که مسلم است در این اقوال جزء دوره اشکانی محسوب شده است و باید برای علت اختلاف — جزئی این آراء در مقایسه‌های تاریخی بیشتر دقت کرد بیرونی در کتاب تحدید نهایات الاماکن مینویسد که داریوش خواست دریای احمر را به مدیترانه متصل کند و ترعه ای که از آن کرد عجیب‌تر آن است که در سنگی که به حجرالرشید معروف است و امروز در فرانسه نگاهداری میشود به زمان این موضوع نگاشته شده که ناپلئون امپراطور فرانسوی با تطبیق این خطوط توانست خط هیروگلیفی را بخواند و علم مصرشناسی آغاز شود و بدون حجرالرشید امکان آن عصر از ماهیت کاشی اطلاع نمیشد بیرونی در کتاب نامبرده مینویسد ناچار باید از جنوب افریقا راهی به اقیانوس هند باشد زیرا کشتی شکسته های هندی در مدیترانه پیدا شده

اطلاعاتی که ایرانیان از مانی داشتند بسیار دور از حقیقت بود و تنها او را بنام مانی نقاش میخواندند که در زمان شاهپور ساسانی از چین بایران آمده و فردوسی روی مدارکی که در دست داشته درباره شاهپور چنین گوید

بیامد یکی مرد گویا ز چین | که چون او مصور نبیند زمین
بدان چرب دستی رسیده بکام | یکی پرمنش مرد مانی بنام
بصورتگری گفت پیغمبرم | ز دین آوران جهان برترم

روی همین شهرت مانی است که حافظ گفته است

نازم باورت باید روا ز صورتگر چین پرس
که مانی نسخه میخواند ز نوک کلک تصویرم

(یکسره آنچه را که در دین ها نگاشته اند کنار میگذاریم زیرا نویسندگان این دفاتر را توجه و عنایتی بدین ابا نبوده و در اکثر این کتب به نقل از سخن ها مانند که بیشتر آنها ساختگی است کفایت شده و من آنچه را که از زمانه خود زردشتیان بدست آورده ام که بنای اعتقاد دینی توجهی خاص و عنایتی مخصوص بدین روزها داشته اند در اینجا نقل میکنم .

در کتب زادویه بن شاهویه و خورشید بن زیار موبد اصفهان و محمد بن بهرام بن مطیار مطالبی در این بحث یافتم که مرا از دیگر مراجع بی نیاز کرده و آنها را در اینجا بازگو میکنم

همچنین از کتب دیگر مانند شاهنامه ابومنصوری که فردوسی هم از آن بهره مند شده و دیگر کتب نیز استفاده کرده . پس از بیرونی برخی از علمای تاریخ احتمالا از تورات اطلاع داشتند که کورش پادشاه بزرگ ایران یهود را از اسارت کلدانیان آزاد ساخت ولی چون نام کورش را در سلسله پیشدادی و کیانی ندیده بودند ناچار طبری او را یکی از سرداران بهمن پسر گشتاسب دانسته و گاهی هم او را با کیکاوس افسانه ای یکی شمرده ولی آنچه از برای او مسلم بوده این است که هیچگاه کورش بشاهی نرسید و او که فرماندار از ناحیه کیان بود از طرف لهراسب در مقام خود تثبیت گردید و بیرونی در آثار الباقیه کورش را از پادشاهان کلده بشمار میاورد که در سال سوم پادشاهی او بنای بیت المقدس تجدید شد ولی این مرد که همواره در جستجو بوده پس از آنکه در آثار الباقیه نوشته های جریر طبری را بازگو میکند در قانون مسعودی یک جدول کامل از پادشاهان هخامنشی ذکر میکند و پس از او در تاریخ صابی نیز بچنین جدول برمیخوریم اما قسمتهای زیادی در جدول فراهم آورده بیرونی است که در کار بتانی نیست .

این ادوار پنج قسم است که دیر (محرور) مورد مقابل از همه کاملتر است و از این رهگذر معمول گشته از سوی دیگر روز اول سال نباید دوشنبه و چهارشنبه و جمعه باشد زیرا صوم آنان به روزهایی می‌افتد که مانع انجام آن میشود مثلاً اگر جمعه را روزه دارند چون روزهایشان بیست و پنج ساعت است مقداری از روزه داخل مدت حد سبت میشود که از غروب شنبه آغاز می‌گردد و ناراحتی سبت معارض است و اشکالاتی دیگرهم در صورت داشتن این سه روز را اول سال روی می‌دهد بنابراین هم باید چاره جویی شود وبرای دو تعدیل مذکور جداول و حسابهای دقیقی ترتیب داده‌اند که بیش از اندازه در آنها دقت شده .

در بادی امر چنین بنظر می‌رسد کهاین جداول و کارهای نجومی از زمان خروج از مصر کار خود یهود بوده و بیرونی در این موضوع چیزی نمی‌گوید ولی تصور می‌کنیم گمان نزدیک به یقین که از زمان موسی تا اسارت کلده به طوری باروس عامیانه این مشکلات را رفع ورجوع میکردند ودر کلده که بدون شك مرکز علم نجوم بوده و هنوز نام درحساب — باروس ریست بخش کتب نجوم آنجا این جداول و حسابهای دماغ مرسا استفاده شده بالاخره که ماههای دوازده‌گانه این قوم تمام ماههای کلدانی است وارسطو در کتاب سماء و عالم یونانیان را مرهون کلدانیان می‌داند و از ارصاد و اعمال نجومی این قوم‌شرافتمندانه تقدیر کرده است .

اگر نویسنده مقاله تقویم یهود از بیرونی سپاسگزار است که نگذاشت این معلومات از میان برود ما ایرانیان بیشتر از او از بیرونی سپاسگزاریم که نگذاشت معلومات بسیار ارزنده درباره اعیاد و ایام و تواریخ مربوط به ایران فراموش شود و اگر کار او نبود این قسمتها نیز از خاطرها می‌رفت و راجع به کتب رائج آن عصر چنین می‌گوید

(A F)

آثارالباقیه ازچه موضوعی گفتگو میکند ؟

این کتاب از ایام سال ها و روزهای عیدهای ملل و ساعات و اوقات روزه اهل کتاب و برخی از مذاهب دیگر و رویدادهای تاریخی گفتگو میکند و برخی بین دانش گاه شماری گفته میشود که ترجمه کلمه ی chronologie فرانسه است و در حقیقت این لفظ بمعنای سالشماری است چنانکه در همه موارد چنین نیست و مصریان آنرا به معرفة المواقیت درست برگردانده اند . پیش از بیرونی این مسائل بطور پراکنده در کتب تواریخ و دفاتر نجومی و نوشته های مذهبی ملل موجود بوده و جمع آوری این اطلاعات و دقت و اجتهاد در آنها و سنجیدن این اقوال با مقایسه ها و تاریخی و احیانا" با میزانهای علمی و نجومی و جدا و سنجیدن نهایی بخشها کار مردی است که جهان فروت مانند او را در کوشش و هوش خدا داد و اعتقاد به حقیقت کمتر دیده است ولی در خلال گفتگو ، گاهی بحث بتواریخ ملل و ادیان با مسائل طبیعی و نجومی و غیره میکشد که چون بالعرض سخن بدینجا کشیده شود ، نویسنده از سرمطلب میرود و او خود متوجه است که از موضوع سخن خارج شده

بیرونی گذشته از مقام بلند در ریاضیات نجومی با زبانهای بیگانه آگاهی داشته و از این رهگذر توانسته بیک رشته معلومات دست یابد که در دیگر نوشته ها نیست و برخی از کتب که مورد استفاده او بوده امروز از میان رفته است و دائرة المعارف سی و دو جلدی فرانسه در صفت تقویم یهود میگوید ما این اطلاعات دقیق را مدیون بیرونی هستیم و اگر جهد و کوشش او نبود این مسائل از میان میرفت . سال یهود شمسی و قمری است lunisolaire و چون شب پانزدهم نیسان از دریا گذشته و بخشکی رسیدند و هنگامیکه فرعون و سپاهیان که از پی این قوم آمدند غرق شدند و ماه هم در حال بدر بوده و دشت را از شعاعهای سیمگون خود سپید کرده بود و درختان هم جامه ی سبز در بر پوشیده و شکوفه ها بار شده بود ، موسی ایشانرا امر کرد که این حال را که ماه در استهلال باشد و زمان بهار همواره بیادگار رهایی از اسارت حفظ کنند از اینجا یهود ادواری ترتیب دادند که این نتیجه را می بخشید که آن حال همواره ثابت بماند

جمع نوشته و گویا در نقل و انتقال کتابهای او آن کتاب گم شده.

٠٢ــ رساله‌ایست بسیار مختصر مربوط به اصطرلاب و در کتابخانهٔ ملی بشماره ٦٤٠ موجود است ــ جزء آثاری که از بیرونی مانده رساله‌ایست در سؤال و جواب با ابن‌سینا که عربی آن در مصر چاپ شده و ترجمهٔ فارسی آن در نامهٔ دانشوران

آنچه از آثار بیرونی که یا معدوم شده یا بطور پراکنده در کتابخانه‌های دنیا موجود است قابل استفاده بوده اگر رساله‌ای که در نور و شعاع نگاشته در دست بود حداقل تاریخ این مسئله روشنتر میشد واگر رساله‌ای که در ترجیح و تفضیل‌های اعراب در شمار اعداد بر رای هندیان نوشته در دست بود بسیار مطلب تازه و قابل تأمل بود زیرا دنیا در وضع عدد مدیون هند است و چون یونانیان صفر نداشتند هرگاه عددی بزرگ می نوشتند بسیار طولانی می شد وبه کار بردن دهگان وصدگان و هزارگان از هند است و در کتب، اعداد هندی ذکر شده وبرخی از این صد وسه اثر کتابهای ادبی بود که از آنجمله است افسانه خنک بت وسرخ بت که در میان موجود واز آثار بودایی است و مردم آن حدود حکایتهای گوناگون از این دو بت داشته‌اند و عنصری این افسانه را نظم کرده که او هم همان راهی رفته که نثر بیرونی رفته

۱۳ــ تصویر الکواکب والبلدان.

این چهاررساله که رساله اخیر وصفحه کاغذ پشتی اسناخیراً ازریر پیدا شده وفعلاً آن نسخه در دانشگاه است وعکس هرچهار نسخه نزد بنده موجود است ورساله فی تسطیح الصور که از تسطیح گفتگو میکند شامل شمار زیاد الف قسمت آخر آثار الباقیه در تسطیح وکاتی را نیز در بر دارد.

۱۴ــ الجماهر فی معرفة الجواهر که شامل وزن مخصوص فلزات وجواهرات است ودر هندوستان بچاپ رسیده وتنسوق نامه ای ایلخانی تعلیم خواجه طوسی ترجمه آن است.

۱۵ــ کتاب التفهیم که شامل مقدمات اولیه علم نجوم است به عربی وفارسی آن بچاپ رسیده.

۱۶ــ کتاب مالِلهند که اسم دیگری دارد وهمان مالِلهند (آنچه برای هند است) کافی است کتاب در آلمان بچاپ رسیده وقسمت فلسفه آنرا بفارسی ترجمه کرده ام

۱۷ــ کتاب پاتنجلی که آنرا ریتر در آلمان بچاپ رسانیده وآن کتابی عرفانی است

۱۸ــ مقاله ای در استخراج مساحت زمین با رصد انحطاط افق از قله جبال که همان مسئله انحطاط یا ارتفاع افق است که بیرونی مخترع این قاعده است وبا پیدا کردن شعاع محیط را یافته بعکس اراتوستنس ومنجمین عهد مامون که محیط زمین را با پیدا کردن یک درجه از سطح آن پیدا کرده اند واین نسخه خطی است وبه آلمانی هم ترجمه شده ونسخه در آلمان است وبنده عکس از نسخه خطی برای علیمور فرستاده که موجب شکرگزاری اوشد واین مسئله بطور مشروح درفصل هفتم مقاله ی پنجم قانون مسعودی شرح داده شده وجزء کسی که ذکر کرد تنها است مقاله را من دیده ام.

۱۹ــ رساله است فارسی در احکام نجوم ومرحوم شیخ الاسلام زنجانی صفحات آنرا از

٦ـ راسیکات.

این چهار رساله بیرونی در هندوستان چاپ شده و اخیراً استخراج الاوتار را در مصر مهندس احمد سعید دمرداش به کومک دیگری شرح کرده و کار بسیار سودمندی انجام داده.

٧ـ تحدید نهایات الاماکن. این کتاب در ترکیه چاپ شده.

٨ـ مقالید علم الهیئه. این کتاب در زمان منصور بن عراق و ابوالوفای بوزجانی است که بوزجانی مدعی بوده شکل مغنی و ظلی را خود او اختراع کرده و ابوریحان میگوید شکل مغنی از منصور بن عراق است و شکل ظلی از بوزجانی. این کتاب بسیار ارزنده است زیرا این دو شکل امروز در مثلثات کروی بکار میرود و بعد خواجه طوسی رساله‌ای در مثلثات کروی نوشته که حاوی این مسائل است و پیش از او کسی بطور مستقل در این موضوع کتابی ننوشته و کتاب خواجه در اسلامبول به طبع رسیده و ملمو ... ساوت ابوریحان را در تاریخ نجوم اسلامی درست ندانسته و حق برای دانستن واقعیت امر در مثلثات کروی مدتها صرف وقت کرده‌ام و چون بر این گمانم که میان کارهای بیرونی و صفحه مطبق باره شش نسبت یکی در تسطیح کره و دیگری در مثلثات کروی پس از آنکه رساله تسطیح را بسپارد از جهت شرط حیات نسبت دوم کارم را عرضه مند ارم با خدا خواهد. کتاب بیرونی خطی است و منحصر به فرد و در کتابخانه مدرسه سپهسالار موجود است

٩ـ الاستیعاب فی وجوه الممکنة فی صنعة الاصطرلاب. این کتاب خطی است و در تهران موجود است

١٠ـ فی صنعة الاصطرلاب

١١ـ تسطیح الصور

١٢ـ تصحیح الصادی

مجموعه کتب و مقالاتی که بیرونی یادگار گذاشته صد و سه عدد است و چون مقالات استاد خود نصر بن عراق و مقالات دوست خود ابوسهل مسیحی را بسیار دوست می‌داشته آنها را فرزند خوانده خود دانسته و غیر از این صد و سه اثر در شمار تألیفات خویش جا داده و من در حواشی یک مقاله از نصر بن عراق در تهران سراغ داشتم و ظاهراً حیدرآباد پانزده رساله از او را در یک مجموعه چاپ کرده و میان آثار این مرد ریاضی‌دان برخی از مقالات است که در زمان حاضر به آلمانی ترجمه شده و شامل افکار بلند اوست و جای این سخنان جای دیگر است.

اینجانب که از آغاز شباب در جستجوی آثار ابوریحان بوده‌ام کتب ذیل را از این صد و سه اثر موجود یافته‌ام.

۱ــ آثارالباقیه که تقریباً صد سال پیش یک نسخه بسیار نفیس در تهران بوده و عین همان را زاخائو در لیپزیک چاپ کرده و نسخه کامل از آن در اسلامبول موجود است که عکس آن مورد استفاده قرار گرفته و ساقطاتی از کتاب در آنها پیدا شده

۲ــ قانون مسعودی که در کتابخانه اعتماد السلطنه بوده و بعد این نسخه از ایران بیرون رفت و دانشمندی آلمانی هفت نسخه خطی از آن در دنیا یافت و نسخه اکسفورد سیصد و هفتاد و پنج هجری نوشته شده که سی و پنج سال پس از مرگ ابوریحان است و چون آن دانشمند به قراری که شنیده‌ام در بمباردمان آلمان از میان رفت ابوالکلام آزاد نسخه تصحیح شده آن را به پول دولت هندوستان خریداری کرد و در هند چاپ شد

۳ــ استخراج الاوتار.

۴ــ افراد المقال فی امر الاظلال.

۵ــ تمهید المستقر لمعنی الممر.

نظری به کتابهای ابوریحان

"ابوریحان بیرونی ولادت ۳۶۰ هجری در خوارزم ، وفات ۴۴۰ هجری در غزنه"

ابوریحان فهرستی فهرستی از نوشته های رازی تهیه کرده که برای تشخیص کتب اصلی این پزشک وکتب منسوب باو از دیدگاه تاریخ طب بسیار ارزنده است و چون فهرست کتب او نیز مورد تقاضای دانشمندی قرار گرفته از کارهای خود نیز فهرستی فراهم آورده که ما را به مصنفات او راهنمائی میکند .

اگرچه از معاصر او ابن سینا نیز آثار بسیاری مانده ولی پس از تدبر در مجموع آثار این دو دانشمند معاصر ، بناچار رسیده ام که تنوع کار در کتب ابوریحان بیشتر است وکمتر اتفاق افتاده که دو اثر او در یک موضوع باشد وحال آنکه کتب ابن سینا تقریبا حفظی است ، نجات خلاصهٔ اشارات و اشارات تنبیهاتی از شفا میباشد این است که در مقدمهٔ روانشناسی شفا نوشته ام که میتوان گفت ـ ابن سینا دو کتاب بیشتر ننوشته قانون در طب وشفا در فلسفه و در میان کتب شفا هم بگواهی اهل خبرت وبصیرت که ذکر کرده ام بهترین کتاب روانشناسی آنست که ترجمه آنرا پرداختم و اخیرا" به چاپ چهارم رسیده و چون مقاله سوم آن مشروحا" در نور و رنگ وکیفیت ابصار است هنگامی که آنرا خواهید عقائد ابوریحان را در این کتاب آن بعد از خلاصه که با ابن سینا در این موضوعات گفتگو کرده ، برای شما روشن میشود چنانکه بسیاری از مسائل طبیعی کتاب حاضر از قبیل اینکه خلاء ممکن است یا محال و اینکه خلاء حافظ اشیاء ـ میباشد چه معنی میدهد ، با توجه به ترجمه کامل مرحوم فروغی در کتاب فن سماع طبیعی با این مسائل آشنا میشوید

بیرونی در رساله تسطیح صور میگوید من به نقشه ای بیارسیدم که کواکب حول معدل و منطقه دو نیم شود زیرا شمار این ستارگان بیشتر است و در چشم روشنتر دیده میشوند. البته نمیدانیم که آیا برخی هم بدوا* در این نوع ستارگان حرکت عرضی را پیدا کرد ولی در — آثار الباقیه به مقصود خود موفق شد میگوید

* به قصد بگذار تسطیح ، تسطیح استوائی نام دارد و تاکنون نشنیده ام هیچیک از اهل ن این نوع تسطیح را پیش از من ذکرکرده باشند

هنگامی که استوانه* محیط برکره گسترش یافت نصف النهارات و مدارات مربعاتی تسطیح شده و نواحی استوائی تقریبا واقع و هرچه دورتر میرویم اشکال واقعه برکره بیشتر تغییر شکل میدهند و بیرونی راجع به عیب مذکور میگوید* ابعادی که درکره متساوی هستند در این تسطیح اختلاف بسیاری یابد بخصوص و اشیاء نزدیک به قطب* چنانکه می بینید تسطیح استوائی از بیرونی است و مقصد او در این کار تسطیح آسمان بوده تاکواکب حول منطقه و معدل را تصویرکند ولی مرکاتور این تسطیح را برای دریانوردی بکاربرده و چون درکره اقصر فاصله میان دو نقطه قوسی از دائره عظیمه است که تسطیح آن خط — مستقیم میگردد و این خط با نصف النهارات زوایائی تشکیل میدهد که چون یك مرتبه بدست آمد کشتیرانی همان زاویه را در حرکت کشتی حفظ میکند پس مرکاتور مقداری در تسطیح استوائی ابداعی بیرونی تصرف کرده و آنرا در زمین هم قابل استفاده قرار داده است این چند تسطیح که ذکرشد نتیجه تقریبا" دویست سال کاربوده که از زمان کندی تا زمان بیرونی را شامل میشود .

سطیح را اختراع کردند که بر سطح استوا نصف‌النهارات و مدارات تسطیح شود در نتیجه نصف النهارات بصورت خط مستقیم و مدارات بصورت دوائری حول مرکز که تصویر قطب است خواهد افتاد .

این همان تسطیح قائم است که بر استوا تسطیح شده ولی در این کار دو عیب موجود است یکی از نظر بیرونی یکی از نظر ما که بسبک علم جدید کار قدمارا می سنجیم و این عیب بسیار روشن است که اگرچه مدارات بتواری ترسیم میشود ولی فاصله آنها بر خلاف آنچه ایشان گفته‌اند مساوی نخواهد بود و آنها نسبتهای مثلثاتی را بکار می‌بستند و ما میگوئیم شعاع هر یک از دوائر صغار عبارتست از کسینوس عروض بلادی که این دوائر بر آنجا میگذرد نسبت بشعاع کره در صورتیکه واحد باشد پس این تصرف که در کار مزبور شد آنرا بصورت غلطی در آورد .

اما عیب آن از نظر بیرونی آنست که صور کواکب چون در دو نیم دائره ترسیم میشود کواکب قلب العقرب بعضی در این دائره و بعضی در دائره دیگر میافتد و چنانکه خود اورا در آثار الباقیه میگوید برای برطرف کردن کمی این عیب را باید بدیگر تسطیح متوسل شد

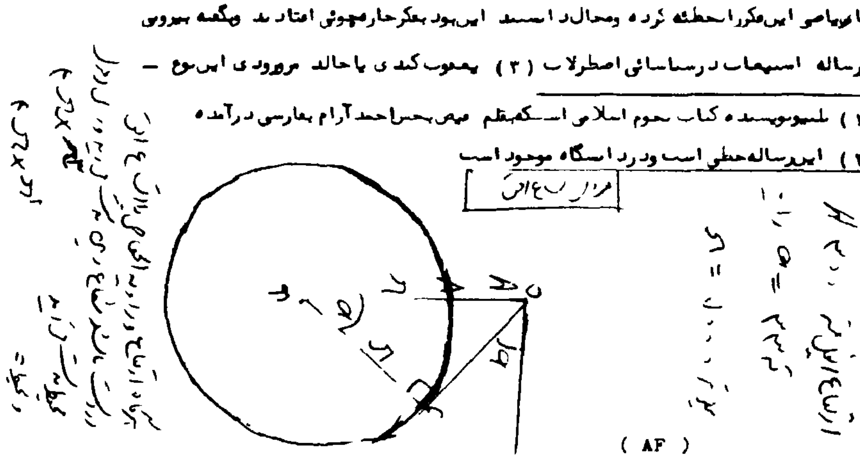
معروف است ودر قانون مسعودی میگوید " بسیار حریص بودم این تجربه را تکرار کنم وبیابانی را که میان جرجان وخوارزم تا دهستان بود برای این مقصود پسندیدم ولی راه خطرناک بود ویاری موافق که مرا کومک کند نیافتم چون همواره در این اندیشه بودم آنگاه که در هندوستان بودم از کوهی عبور کردم که پیش روی آن دشتی هموار بود که میشد آنرا بجای سطح دریا بکار ببندم ود ومرتبه جلو وعقب زمین هموار ارتفاع آن کوه را پیدا کردم وزاویه انحطاط افق را نیز یافتم وروی قاعده ابداعی خود توانستم مقدار شعاع زمین را بیابم واز راه شعاع محیط را یافتم که با آنچه آن محاسبان گفته بودند یکی درآمد آنگاه دلم تسکین یافت "

مسلم این است که فرمول مذکور از بیرونی است وکار نالینو وویدمن هرد واین موضوع را تصدیق دارند (۱) در مسئله تسطیح کره علمای تاریخ ریاضی خبری نگفته اند این مسئله را بیشتر اساسا میدانم

بیرونی در رساله تسطیح صور (۲) میگوید که بطلمیوس از مارینوس نقل کرده که او خطوط مستقیم بموازات نصف النهار مید اده وخطوطی هم بموازات دائره عرض ترسیم کرده ومحل التقای این دو خط را از عرض وطولی که در محل التقای دائره عرض با طول قرار دارد دانسته و علمای ریاضی این فکر را تخطئه کرده ومحال دانستند این بود بفکر جاز مهوش افتادند وگفته بیرونی در رساله استیعاب در ساختن اصطرلاب (۳) بعنوان کندی یاد شده مروودی این نوع —

(۱) نلینو نویسنده کتاب نجوم اسلامی است که بقلم مهندس احمد آرام بفارسی درآمده

(۲) این رساله خطی است ودر دانشگاه موجود است



این کپلر نبود که از کارهای بطلمیوس بهره‌مند شد بلکه خود بطلمیوس است که از روی خسوف های بابلی که تفصیل هر سه را بیان کرده توانست مقدار حرکت وسطی ماه را بدست آورد .

حال اگر خسوف های بابلی مورد استفاده قرار گرفته چرا تابلوی صفحه چهل و یک قانون مسعودی که بیرونی ارصاد حریقسی را فراهم آورده و بوده رصد را که هیچ عدد از آنها را ابرخس و دو عدد را بطلمیوس و دو وارده عدد آن را منجمان اسلامی که یکی از این دو وارد ما ابوالوفای بوزجانی است و سه رصد هم از خود اوست ، با تعیین مشخص امکنه و ازمنه ذکر کرده مورد استفاده قرار نگیرد .

حرکت اوج شمس که بطلمیوس برخلاف ابرخس جدا" منکر آن بود با دقت در ارصاد عقیده ابرخس به کرسی نشست و بصورت مسئله‌ای مسلم درآمد و فصل ششم مقاله ششم قانون مسعودی در استخراج مقدار حرکت اوج است.

بیرونی مطلقا" در مقادیری که در کارهای نجومی پیش از او گفته‌اند شک داشت و سه مرتبه میل کلی را در سالهای مختلف استخراج کرده و در هر سه مرتبه ۳۵" ۲۳° و ابوالوفا هم همین اندازه بدست آورده که با آنچه ما امروز میگوئیم ۲۷" ۲۳° نزدیک است و چون در عصر مأمون در مقدار واحد مقیاس یونانی اختلاف شده بود و از نو تخمین بامر مأمون محیط زمین را با پیدا کردن یک درجه از نصف النهار پیدا کردند در قسمت این عمل بیرونی شک و — تردید داشت راه دیگری به فکرش رسید که امروز بنام انحطاط افق

شاید بسیاری از فضلا بر این عقیده باشند که کتب یا متون قدیم در قسمت هیئت و نجوم با پیشرفت علم ارزشی ندارد و اشتغال به آنها تضییع عمر است ولی مسلماً این فضلا در اشتباهند زیرا علم نجوم فعلی روی پایه‌های علم نجوم قدیم گذاشته شده و همین بکارهای قدما نیازمندیم

پس از آنکه در اثر کوشش چند هزار ساله به ثبوت رسید که مرکز عالم از مرکز دایره خورشید (بعوض بطلمیوس که خورشید بگرد زمین که مرکز عالم است حرکت کند یا بعکس کپلر که خورشید ساکن باشد و زمین بگرد او حرکت کند) دورتر است ، و این دو دایره متحد المرکز نیستند و مقدار اختلاف فصول از اینجا ناشی شد و مسئله مربوط که تعدیل شمس نام دارد بمراتب عمل شد و پیروی از بعد بین المرکزین را استخراج کرد ، ناگاه کپلر پیدا شد و قانون اول خود را بیان کرد که سیارات بدور آفتاب مداری بیضوی می‌پیمایند ، که آفتاب در یکی از دو کانون آنها قرار دارد .

حال اگر خروج از مرکز قبلا تعیین نشده بود آیا کپلر میتوانست که قبلا این مسئله مهم را کشف کند و بعد هم قانون اول خود را وضع نماید و همین کاری را که کپلر با فرضیه یک مدار بیضوی میکند بطلمیوس با دو دایره غیر متحد المرکز که در یک نقطه مماس داخل میشوند و هر دو کار به یک نتیجه میرسد چرا اینکه البته اگر یک مدار باشد بهتر است تا دو مدار فرض شود

شروع مسئله در طرز رفتار

منابع و مآخذ

۱- [illegible] در علم از [illegible] انتشارات [illegible]

۲- «المدخل التعليمي» تأليف رازی، به کوشش [illegible] انتشارات [illegible]
تهران، توس [illegible] ص، سال ۱۳۴[illegible] شمسی

۳- «[illegible] الاسرار» تألیف رازی، ترجمه و تحقیق [illegible]، انتشارات
دانشگاه تهران، توس ۱۴ ص، سال ۱۳۴۹ شمسی

۴- [illegible] دکتر محمود نجم آبادی [illegible] سال ۱۳۱۸

۵- [illegible] تألیف دکتر محمود نجم آبادی، انتشارات دانشگاه
تهران، توس ۵ ص، سال ۱۳۴۹

۶- [illegible] ایران [illegible] تألیف [illegible]
انتشارات [illegible] ایران، توس ۲ ص، سال ۱۳۵۲ شمسی

۷- [illegible] تألیف [illegible] (Paul Kraus) [illegible] ۱۹۴۲ میلادی

۸- ترجمه و تحقیق [illegible] تألیف [illegible] به کوشش [illegible]

۹- ترجمه [illegible] به کوشش [illegible] تهران ۱۳۳۱

۱۰- [illegible]

۱۱- فرهنگ [illegible]

۱۲- [illegible] تألیف [illegible] چاپ [illegible] ۱۳۵۵

۱۳- [illegible] تألیف رازی، به کوشش [illegible] ۱۹۲۷ میلادی

[illegible] B [illegible]

[illegible] نوشته

[illegible]

باید [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

تهران ۱۷ شهریور ۱۳۵۲

= ۸ سپتامبر ۱۹۷۳

[illegible]

(AD)

[illegible] ترتیب

اکنون در کتابهای [illegible] داریم و کتابهای [illegible] [illegible]

[illegible] [illegible] است که [illegible] [illegible]

[illegible] در [illegible] چاپ [illegible] ترجمه لاتین آن [illegible] در اروپا [illegible]

[illegible] است تا که اگر [illegible] آنها [illegible] مطلب [illegible] اکثر

[illegible] روابط [illegible] دانسته اند

[illegible]

[illegible] است تا آنکه [illegible] معاصر [illegible]

[illegible] است

[illegible]

[illegible]

[illegible]

[illegible]

در خاتمه مقال [illegible] عرض می‌کنم

آنچه که [illegible] یکی از [illegible] است که

[illegible] دانشمندی [illegible] محقق [illegible]

[illegible] بزرگ [illegible] که [illegible]

[illegible]

پس رازی را به قمری ۶۰ سال و ۵ روز و به شمسی ۶۰ سال و دو ماه

و کمی دور دانسته و چون او از ریاضیات ... بعضی رساله‌های [illegible] و طبیعیات

متعدد بود. قطعاً است که طول عمرش بسیار معتدل است

در فهرستی که بیرونی برای آثار رازی تحریر کرده [illegible]

دلیل است که رازی در علوم عصر خود تبحر داشته و [illegible] در قسمتهای از

علوم حکمت و منطق و طبیعی و ریاضی علم عقیده [illegible] آثار رازی

را [illegible] است نوشته است

لازم به تذکر است که بیرونی در فهرست [illegible] آثار رازی را طبق

نحو آورده است

1) در طب و داروسازی ۵۶ اثر؛
2) در طبیعیات ۳۳ اثر؛
3) در منطق ۷ اثر؛
4) در ریاضیات و نجوم ۱۱ اثر،
5) در تفاسیر ~~[illegible]~~ و تلخیص و اختصارات ۷ اثر،
6) در فلسفه و تخمینیه ۱۶ اثر،
7) در ما فوق الطبیعه ۶ اثر،
8) در الهیات ۱۴ اثر؛
9) در کیمیائیات ۲۱ اثر،
10) در فنون متفرقه ۱۲ اثر؛

جمع ۱۸۴ اثر

[illegible]

[illegible] رساله‌ای از رسالات [illegible]

رازی را که [illegible] دکتر ماکس مایرهوف[1]

[illegible] رازی ارسال داشت [illegible] التحقیق [illegible]

[illegible] رازی [illegible] که [illegible] تحسین و تحمید [illegible]

آن که [illegible] تحقیق کرده‌ام [illegible] رازی [illegible] ۲۷۲ تا ۲۷۳ از طبع [illegible]

[illegible] ۱۱۵ دارد [illegible]

[illegible] منصور [illegible]

[illegible] تألیف [illegible] آورده‌ام.

[illegible] و شرح [illegible]

[illegible] فهرست [illegible] ۱۸۴ اثر ذکر کرده که ۵۶ [illegible] ۱۰۳

[illegible] رازی است

[illegible] شرح [illegible] رازی [illegible]

آورده است

[illegible] رازی را در غره شعبان سال ۲۵۱ هجری قمری

(= ۲۷ اوت ۸۶۵ میلادی) و وفاتش را در پنجم شعبان ۳۱۳ هجری

قمری (= ۵ اکتبر ۹۲۵ میلادی) [illegible] است آنگاه.

1- Dr Max Meyerhof

تنها در خط آموزی آن دوران [illegible] که بنا در رسالات و آثار خطی
وارد شد

از [illegible] دیگر باقی است ابن الندیم در «الفهرست» و القفطی
در [illegible] و ابن ابی اصیبعه در «عیون
الانباء فی طبقات الاطباء» و حاجی خلیفه در «کشف الظنون» تکرار
[illegible] بیرونی آثار آورده اند

از نظر قدمت تاریخی ابن الندیم بر همه اینها مقدم [illegible] بالا مقدم است،
اما چون بیرونی احتمالا فهرست مخصوصی از آثار رازی آورده است،
سطر به سطر [illegible] معتبرتر است. به همین جهت در کتاب
[illegible] مولفات [illegible] محمد زکریای رازی» که
در سال ۱۳۴۹ [illegible] ضمن انتشارات دانشگاه تهران [illegible]
[illegible] بیرونی [illegible]

[illegible] در سال ۱۳۱ شمسی (که [illegible] ۱۳۵۲ است) [illegible]
[illegible] آثار علمی رازی مطالعه کرده ام [illegible] رازی
در عالم علم [illegible] تهران [illegible] است

[illegible] سال ۱۳۱۸ شمسی کتاب [illegible]
[illegible] تحریر [illegible] دانشمند [illegible]

(D)

مج) من العلة التي لها يرى جمع جهال الأطباء أن القليل يعلمون،

مد) في التعريض؛

مه) من العلل التي تعرض لطبها والتي تعرض لظهورها لعلة،

مو) من علة [illegible] الموت الوحي من السموم؛

مز) من أن الحمية المفرطة ضارة بالأصحاء؛

مح) من أن للطبيب المشتغل به منافع،

مط) من علة تعطيش السمك؛

ن) من العلة التي لها صار النائم يعرق أكثر من اليقظان،

نا) من العلة التي لها صار الحريف ممرضا؛

نب) من العلة التي (لها) يبرئ الحمرة بالتلطيف مرة وبالتبريد؛

نج) من أن الطبيب الحاذق ليس بقادر على إبراء العلل كلها وأن ذلك ليس من وسع البشر،

ند) من أنه ينبغي للطبيب أن يتلطف لإيصال الناس إلى شهواتهم،

نه) من الأغراض المحيلة لقلوب الناس كثير من الناس عن أفاضل الأطباء إلى أخسائهم؛

نو) من العلة التي لها ترك بعض الناس رأي الطبيب وإن كان حاذقا،

نز) من العلة التي لها ينجح جهال الأطباء والعوام أكثر من العلماء.

/

كد) في هيئة الكبد؛

كه) في هيئة القلب.

كو) في هيئة الانثيين.

كز) في هيئة الصماخ.

كح) في الفصد؛

كط) العصيرة.

ل) كتاب الابدال.

لا) اطعمة المرضى.

لب) منافع السكنجبين؛

لج) علامات الاسنه

لد) كتاب جمع فيه الاعمال بالحديد،

له) كتاب اكبر من العطر والانجاسات والارطال؛

لو) ترتيب الفاكهة قبل الطعام وما بعد منه؛

لز) فيما جرى بينه وبين جرير الطبيب في التوت عقيب البطيخ،

لط) في العلة التي كانت تعتري ابا زيد في وقت الورد)،

م) في العلة التي تحدث الورم والزكام في رؤوس الناس [وقت الورد]،

ما) في وجوب الاستفراغ في اوائل الحميات؛

مب) في الماء المبرد بالثلج والمبرد على الثلج،

ه) الرد على المتشبه في صنعة الطب.

و) في محنة الطبيب وكيف ينبغي أن يكون،

ز) المرشد،

ح) الكناش المنصوري عمله لمنصور بن اسحق قرابة والي خراسان،

ط) تقاسيم العلل ويعرف بالتقسيم والتشجير،

ي) الطب الملوكي،

يا) من لا يحضره الطبيب،

يب) الأدوية المسهلة الموجودة في كل مكان،

يج) القرابادين الكبير،

يد) القرابادين الصغير،

يه) الإكليل، منسوب إليه،

يو) كتاب العجز منسوب إليه،

يز) دفع مضار الأغذية،

يح) كتاب الجدري والحصبة،

يط) كتاب في تولد الحصاة،

ك) كتاب في الترياق،

كا) كتاب في التدبير وأوجاع المفاصل،

كب) كتاب في القولنج،

كج) كتاب في اللقوة.

٪

تا [illegible] در میان دانش‌های ایرانی مقتضی

پرسش [illegible] که درست به تحریر همین تألیفها [illegible] است ؟

تا [illegible] میان [illegible] اروپاییان آنها [illegible] قرار الهام است ؟

اروپاییان از این دانش در تمدن اسلامی است که در باب دانشمند [illegible] اسلامی [illegible]

[illegible] گشته ، [illegible] برای دانشمندان [illegible] نیز به همین

تألیف درست [illegible]

[illegible] که [illegible] آنها [illegible] را [illegible]

[illegible] در تمدن اسلامی [illegible] الهام است

[illegible] تحت عنوان « [illegible] » [illegible] کتب [illegible]

[illegible] سال ۱۹۲۶ در مجله [illegible] است .

[illegible] ۵ [illegible] است [illegible] و [illegible]

[illegible] آن [illegible] .

آن [illegible] که [illegible] ارتباط دارد [illegible]

[illegible] ۵ [illegible] [illegible] آورده است

۱) [illegible]

۲) [illegible] الطلب ،

۳) المدخل الی الطلب ،

۴) الرجوع الی حد [illegible] الطلب ،

1- Paul Kraus

[illegible]

[illegible]

۹ – [illegible]

[illegible]

۷ - این موضوع ~~[illegible]~~ عرض کنم که اسم های ایام هفته را
سابقاً [illegible] در تقاویم [illegible] تورات و انجیل [illegible] ولی
در تسمیه روزها [illegible] ترجمه [illegible] ذکر کرده در [illegible] مختلف ایام
عرض کردم [illegible]. از آن [illegible] در سه مذهب یهود و مسیحی
و اسلام [illegible] نداشته است
روزهای هفته را [illegible] به سیارات نسبت داده. مثلاً شنبه را به سیاره
زحل که روز زحل انگلیسی (Saturday) و روز یکشنبه را
به اسم [illegible] که روز شمس انگلیسی و آلمانی (Sunday) و
(Sontag) و روز دوشنبه را روز ماه نامیده که روز ماه
انگلیسی و آلمانی (Monday) و (Montag) میشد

۸ - رابطه [illegible] [illegible] مذهب [illegible] از نظرات
[illegible] و [illegible] و طولانی مجرد و [illegible]
[illegible] مطلق [illegible] قدرت [illegible] اعتقادات است. چرا که [illegible]
[illegible] بالا بود [illegible] نظرات اعتقادی
نداشته است.

[illegible] اعتقادات عقیده داشته. [illegible]
[illegible] ~~[illegible]~~ ([illegible]) که اعتقاد [illegible]
[illegible] نظرات [illegible] داشته است.

(AD)

سلسله انتشاراتی است به نام «[illegible]؟» که به زبان فرانسوی

Que sais-je? باشد. اولین بار [illegible] کرد.

سعدی [illegible] در شرح [illegible] کتاب [illegible] گفت:

[illegible] که [illegible] از [illegible] تا [illegible]

[illegible] مقدمه [illegible] کتاب [illegible] در [illegible] و [illegible]

و [illegible] که [illegible] باعث [illegible]

[illegible] گردد

عده‌ای از دانشمندان [illegible] اروپا [illegible] کرده.

که [illegible] است و دیگر [illegible] آنها را

[illegible] . در ایران [illegible] اولی

در [illegible] آنها [illegible]

دانشمندان [illegible] اگر [illegible] گفت که [illegible]

«[illegible]» [illegible] . [illegible] که «[illegible]»

[illegible] در [illegible] گرفتن [illegible]

و [illegible] آنها [illegible] ؟

انگلیسی ترجمه شده است

و به سال ۱۸۸۸ میلادی توسط [illegible] به [illegible] عبدالله [illegible] دارد

[illegible] در هند [illegible] ترجمه کرده است.

کتاب [illegible] به [illegible] کرده است.

در کتاب الهند [illegible] از روی ترجمه [illegible] شده است آن از زبان

[illegible] دست [illegible] مترجم معروف

الهند).

۵ - قانون مسعودی: غیر از کتاب «ما للهند» دیگر از تألیفات [illegible]

که به نام سلطان مسعود غزنوی نوشته است و از [illegible]

قانون مسعودی [illegible]

به [illegible] در علم نجوم [illegible] بیشتر [illegible] است [illegible]

۶ - کتاب «التفهیم لاوائل صناعة التنجیم» که یکی از [illegible] است

[illegible] است که در علم نجوم [illegible] [illegible] کتاب [illegible] است [illegible]

[illegible] اقتباس [illegible]

[illegible] که در [illegible] [illegible]

[illegible] آورده [illegible]. [illegible] که [illegible] می‌شد،

[illegible] در باب کتاب «ما للهند» [illegible] کتاب [illegible]

[illegible] است [illegible] که [illegible] است. [illegible]

[illegible]

[illegible] سلطه میرانید یعنی ترقی در دربار علمی ابوریحان چنان مشترین بود

آنچه که مشترک است ~~[illegible]~~ آثار و دیوان دری میباشد.

به قول محمد داؤد ابوریحان به خوارزم رفت و بار دیگر با سلطان محمود

سفر (به غزنوی) هند و شناختن مستقیم است در این قول لازم حتماً صحیح است،

چرا که اثر بزرگ ابوریحان کتاب ما للهند است که نتیجه سفرهای

وی به شهرها تا به هندوستان میباشد

در سفرها که محمود غزنوی به هندوستان کرد، عده‌ای از شعرای وقت در

سپاه وی فقط [illegible] آثاری دارند، چنانکه در مدح [illegible] [illegible]

[illegible] آن. [illegible] [illegible] شعرا [illegible] [illegible] [illegible] [illegible]

که خواندن آن احتیاجی نیست اما ابوریحان در وقت [illegible]

به مسافرت [illegible] [illegible] قوم را [illegible] [illegible] لحاظ [illegible] [illegible]

[illegible] [illegible] [illegible] شد و در [illegible] هندوستان [illegible] [illegible] آداب

و رسوم و عادات و [illegible] و [illegible] و علوم [illegible] [illegible] که قرار است

کتاب ما للهند را [illegible]

[illegible] کتاب [illegible] [illegible] دائرة المعارف است که [illegible] آن [illegible] [illegible]

[illegible] [illegible] میباشد [illegible] [illegible] کتاب [illegible] [illegible]

آنگاه. ابوریحان به جانب خوارزم رفت و به خوارزمشاه «مأمون» [illegible]
شد. دربار خوارزمشاه مجمع دانشمندان بود. ابوریحان و عده‌ای دیگر به نام
ابوسهل مسیحی، شیخ الرئیس ابن سینا و ابن خمار و ابونصر عراق در
دربار خوارزمشاه بودند.

سلطان محمود غزنوی چون [illegible] را از خوارزمشاه خواست که این دانشمندان
را به دربار غزنه بفرستد. خوارزمشاه آنان را خواست و گفت: محمود بسیار
قوی است [illegible] به غزنین بروید [illegible] هر کدام که خواهد برود. ابن سینا
و ابوسهل مسیحی به [illegible] ولی ابوریحان و ابونصر عراق در [illegible]
به غزنین رفتند.

این عهد [illegible] سلطان محمود غزنوی [illegible] و ابوریحان [illegible]
[illegible] سال [illegible]
ابوریحان [illegible] سلطان محمود [illegible]
[illegible] [1]
[illegible] حقیقت.

۱- [illegible] ابوریحان [illegible]
[illegible]

A [illegible] در ترکستان [illegible] است [illegible] والا میرزا است

[illegible] نگشت.

وی مردی هشمند و ثروتمند بود (ابوریحان) [illegible] آن [illegible] چهار

[illegible] در راه [illegible] می‌گرفت

[illegible] ابوریحان در [illegible] شمس المعالی قابوس [illegible]

[illegible] است. قابوس [illegible] ابوریحان

[illegible]

[illegible] که ابوریحان [illegible] تقریباً [illegible]

[illegible]

[illegible]

[illegible]

کتاب «آثار الباقیه» را به نام شمس المعالی نوشته است.

[illegible] سال ۱۷۸۹ میلادی [illegible] الفیس [illegible]

[illegible] محمد حسن میرزا اعتمادالسلطنه [illegible]

[illegible]

جنبه این امر مهم نیست . آنچه که اهمیت دارد [illegible]
[illegible] است که [illegible]
[illegible] گذارده است

[illegible] تا آنجا که اطلاع دارد [illegible] است
[illegible] گذارده [illegible]
[illegible]
گذارده است

[illegible] سال ۲۵۲ [illegible] ۹۷۲/۳ میلیارد) و
[illegible] سال ۴۴۰ [illegible] ۱۰۴۸/۹ میلیارد) [illegible]
[illegible] سال [illegible]
آنچه [illegible]
[illegible]
[illegible]
[illegible]

۱ - [illegible]

(n D)

همچنین عرض کردم که خواجه طوسی که یکی از ایرانیان بزرگ و از
دانشمندان بزرگ دوره خود بوده و کارها کرده است که هرگز کم کرد از این جمله
دستگیری و نجات دانشمندان و بقیه بزرگان در سرزمینی که هلاکو در پی چپاول بود
عظیم ~~[illegible]~~ تا به امروز طوسی و خواجه طوسی
و حجة الاسلام غزالی و نظام الملک و دو امام فخر طوسی و عده زیادی
دانشمندان و بزرگان خطه این آب و خاک دیگران را آن دوران پیشه
کاملاً بر سر زمین ماوراءالنهر خوارزم به دنیا عرضه داشته که برای
آنان در جهان بی‌نظیر است
آنچه حقیقت به چگونگی دانشمندانی که عرض کردم چون به تمدن و دانش
جهان خدمت کرده‌اند و همه جهانیان از علم و دانش آنان بهره گرفته‌اند
متعلق به جهان می‌باشند و تمام دانشمندان ~~[illegible]~~ در دوره زندگی آنان را
عزیز و گرامی میدارند.

۲ – شرح حال دانشمندان و شاعران بزرگ در ساحل ماوراءالنهر و مدت عمر و تاریخ تولد
و وفات و آثار بزرگ مربوط به آنان و آنچه در طول عمر به چه کار می‌پرداخته
و به یادگار نهاده‌اند و از نظر تحقیق در دانش آنان و تحریر و تکمیل در علم

ابوریحان محمد بن احمد البیرونی

پروفیسر اکبر داناسرشت

[illegible]

LE MESSAGE SCIENTIFIQUE D'AL-BĪRŪNĪ ET SA PORTEE ACTUELLE DANS LES PAYS MUSALMANS

DR M SOUISSI

Il y a mille ans, le 4 septembre 973, naissait Abu-r-Rayhān Muhammad b al-Bīrūnī, dans la banlieue de Keth, chef-lieu de la province de Ḫawārizm, qui fait partie, de nos jours, de la Republique Soviétique d'Uzbekistan C'est ce qui appert de ce que rapporte Samᶜāni (fin du Xe siècle) dans son livre *"Al-Ansāb"* (Les généalogies) "Il faut lire Bayrūni, avec fatḥa sur le bā, il s'agit d'un nom relatif se rapportant à la banlieue de Ḫawārizm, quiconque est de la zone extérieure de la ville, et non de son périmètre intérieur, est dit bayrūni " (1) Par contre, Ibn Abi Uṣaybiᶜa, dans son *"Uyūn al-Anbā'"* (2), prétend qu'il est originaire de Bayrūn, ville du Sind, ce fait est repris par Ahmad Amin dans son *"Zohr al Islām"* (TomeI, p 287)

C'est dire qu'apres coup, la contestation a entoure le nom de Bīrūnī, chaque pays voulant se l'attribuer Ainsi l 'U R S S affirme que Bīrūnī est le représentant type de la nationalité d'Uzbekistan, l'Iran veut l'annexer, du fait qu'il a passé une partie de sa vie dans ce pays, la Turquie y voit un spécimen de la race turque d'Asie Centrale Il y a, dans de telles attitudes, de quoi faire frémir les mânes de Bīrūnī lui-même, lui qui s'est signalé par son extrême tolérance, par sa liberté d'esprit et son ouverture sur l'humain, n'a-t-il pas reproché, en effet, à certaines sectes hindoues d'avoir cru"que la terre leur appartenait, que le genre humain se limitait à leur race que leurs rois étaient les Princes de la terre, qu'il n'y avait de science que la leur"?

Esprit profond, doue des qualités remarquables qui font le véritable savant, curieux, avide de connaissance, consacrant toute sa vie à la recherche rigoureuse, s'astreignant à un travail continu, impassible devant les vicissitudes de la vie, stoïque devant les disgrâces de la Fortune et devant l'injustice des grands de ce monde, faisant fi des occasions qui lui sont offertes pour avoir beins, argent, postes d'autorité ou fonctions honorifiques, Bīrūnī, jusque sur son lit de mort, nous donne le remarquable example de l'homme qui ne trouve le repos du bonheur que dans l'accomplissement de sa tâche, même pénible, même périlleuse, qui n'éprouve la plus grande joie de l'esprit que lors de l'éclair fugitif où il lève le voile sur un sombre recoin où se cache la Vérite, "éclair entre deux éternités de néant, dira un autre savant de la classe de Bīrūnī, Henri Poincaré, mais éclair qui est tout "

Yaqūt nous rapporte cette anecdote relatée par un cadi, ami de Bīrūnī, Abul-Hasan al-Walwāği an-nisābūrī "Je rendis visite, dit-il, à Abu-r-Rayhān alors qu'il était en proie aux affres de la mort, sa respiration était pénible, son souffle difficile Dans l'état où il se trouvait, il s'adressa à moi en me disant Tu m'as parlé un jour du problème de l'héritage des grands mères, veux-tu m'en rappeler les détails?

— Est-ce possible, répliquai-je, alors que tu es tel que je te vois? Et je fus pris de compassion

— Dis-donc, répartit - il, est-ce qu'il ne vaudrait pas mieux que je quitte ce monde en sachant la réponse?'

Je repris donc devant lui l'exposé de la question, il m'écouta attentivement, répéta la suite du raisonnement, puis il me suggéra certaines solutions de la question et des explications qu'il m'avait, dans le temps, promises a ce sujet

Je pris ensuite congé A peine arrivé dans la rue, j'entendis les lamentations qui annoçaient sa mort "

Ainsi s'acheva la vie de ce grand savant, "homme toujours debout sur le Cap Pensée, à s'écarquiller les yeux sur les limites ou des choses ou de la vue"

"J'ai eu en propre, affirme-t-il, par nature, et depuis ma plus tendre enfance, la soif de la connaissance, le goût de la recherche, selon l'âge que j'avais et compte tenu de la situation où je me trouvais"

Il avait faim de lumière Et, à sa manière, il a eté un grand Poète, dans le sens étymologique du mot Ce qui l'a toujours intéressé, c'est le Faire, le "Poīein", la création des oeuvres que l'esprit veut se faire pour son propre usage en employant à cette fin tous les moyens physiques qui lui peuvent servir

Avec une grande curiosité, avec passion même, il a attaché une importance éminente à suivre en lui, presque en spectateur, l'Acte de Création; il a considéré avec une véritable délectation "l'Action qui se fait", l'Action qui fait, plutôt que la Chose faite, C'est Pygmalion amoureux de son oeuvre, c'est, selon le mot de Valéry, "l'Artiste qui, seul, se sent créer" Et par delà l'homme, il a envisagé ce je ne sais quoi auquel il se subordonne et sacrifie, qui le domine et vit de lui C'est le mot de Prométhée "Je n'aime pas l'homme, j'aime ce qui le dévore" (A-Gide)

De toute évidence, une telle attitude trouve en soi sa propre joie et sa propre récompense Observant les astres, résolvant ses problèmes de trignométrie et d'algèbre, rédigeant son histoire de l'Inde, étudiant les propriétés des roches et les phénomènes géologiques, Bīrūnī n'a nullement envisagé les avantages matériels qui pouvaient résulter de ses découvertes fortune, célébrité, honneurs Ainsi, en l'an 421H/1030, il offrit au sultan Mas'ūd de Gazna sa remarquable encyclopédie *"al-Qānūn al-Mas'ūdī"*, où il exposa les connaissances de son temps dans le domaine de l'astronomie, étayant ses propositions par des démonstrations mathématiques rigoureuses et variées, se basant sur les résultats de ses observations, citant des exemples précis, il rappela l'oeuvre de ses predecesseurs guidé par un esprit critique très vif, dégageant les éléments exacts,

signalant les erreurs et les corrections à y apporter, exposant des méthodes nouvelles, simplifiant les problèmes ou permettant de mieux circonscrire la vérité Enchanté, le sultan lui envoya, pour récompense, une charge d'éléphant en pièces d'argent, mais Bīrunī refusa le cadeau et le renvoya au Prince, affirmant que son objectif était uniquement la science pour la science Ce qui l'attirait, c'était ce saut dans l'inconnu qui, avec le succès, donnait a l'homme une volonté toujours plus tendue en vue d'aller plus loin, et de reculer indéfiniment les limites du possible

Parlant de sa vocation et de sa méthode, il écrivait au début de son livre de géographie" *Tahdīd nihāyāt al-amākin li-taṣlīh masāfāt al-amākin* " (409H/ 1019)

"Dans le temps, j'ai eu l'intention, à la manière de Ptolémée dans sa Géographie, de Gribhānī et autres dans leurs ouvrages relatifs aux voies de Communication, de réunir les connaissances éparses, d'en rendre l'accès plus aisé, d'en combler les lacunes J'ai commencé par opérer la correction des distances, l'établissement des noms exacts des lieux et des pays, j'ai recueilli les renseignements de la bouche même des gens qui les ont visités ou y ont séjourné, j'ai pris toutes sortes de précautions et me suis entouré de toutes les garanties, confrontant les dires des uns et des autres Je ne me suis épargné aucun sacrifice pour mener à bien la collecte des documents nécessaires à mon entreprise j'ai prodigué, à cet effect, mon argent et mes biens, j'ai tiré profit de ma notoriété J'ai construit un hémisphère de dix coudées de diamètre, en vue de déterminer les longitudes et les latitudes des lieux, d'après les distances qui sont portées dessus J'ai dû opérer de la sorte, car je ne disposais pas du temps nécessaire pour procéder par le calcul, étant donné le nombre considérable de cas envisagés

Cependant, je me suis astreint à n'utiliser que les précisions fournies par les documents écrits, et j'ai négligé le rapports oraux, pour éviter les erreurs

Mais les tristes évènements qui se sont passés, les malheurs que j'ai subis ont emporté les fruits de mas efforts, balayant, comme feuilles au vent, la documentation réunie

Et si Dieu permet que je reprenne mon objet-et Lui seul en a le Pouvoir!— je ne reculerai pas devant l'effort et je n'hésiterai pas à mettre mon travail à exécution "

Pour Bīrunī, comme pour Valéry, la création n'est pas instantanée

Elle exige des années de mise en condition de l'esprit, de réflexion, elle peut exiger l'expérience et les acquisitions de toute une vie Elle n'existe que dans l'effort, on n'enfante que dans la douleur L'oeuvre de l'esprit n'existe qu'en acte C'est l'attitude classique de rigueur et de contrainte

[Vingt fois sur le métier remettez votre ouvrage] Le lecteur, en tant que consommateur de la production littéraire, artistique ou scientifique, a vite fait pour apprécier une oeuvre considérable, à en ressentir le choc C'est loin de penser à la quantité d'essais, de reprises, d'éliminations et de choix,au nombre

d'observations accumulées et d'expériences effectuées, que ce qu'on appelle "création" intellectuelle a exigés "Les personnes qui ont subi le grand effect produit, et qui ont été accablées par la puissance, par les perfections, par les nombres des coups heureux, des belles surprises accumulées, ne peuvent, ni ne doivent se figurer tout le travail interne, les possiblités égrenées, les longs prélèvements d'éléments favorables, les raisonnements délicats, dont les conclusions prennent l'apparence de divinations, en un mot, la quantité de vie intérieure qui fut traitée par le chemiste de l'esprit producteur ou triée dans le chaos mental par un démon a la Maxwell " (Valéry)

C'est le detail de ces jeux internes, de ces drames qui s'accomplishment dans l'esprit de Bīrūnī qui en font, pour moi, ce géant de la Science, dont la puissance m'écrase et dont la densité me coupe le souffle et qui, malgré tout, reste un homme, avec ses sentiments, ses faiblesses, avec ses extases qui le portent aux sommets supérieurs et ses dépressions qui parfois le mènent au bord du desespoir et du decouragement Vue de l'exterieur, son oeuvre est celle d'un être remarquable guidé par une logique rigoureuse, par une raison sans failles mais en fait, l'oeuvre, pour son auteur, n'est que l'aboutissement d'une série de mod fications dans sa forme dite "définitive", elle n'est qu'une fuite de l esprit en mouvement, hors de son cadre normal d'instabilité et presque d inconséquence La joie de la réussite, la jouissance du succès ne sont que la traduction d'un état d'âme qui, fortement, fait apparaître que ce phénomène aurait pu ne pas être et même, aurait dû ne pas être, se classant dans l'improbable

D'ou les methodes utilisées par Bīrūnī dans sa recherche observations diverses expériences multiples et répétées dans des conditions naturelles variées, calculs basés sur un procédé qu'il a mis en pratique, avant qu'il ne soit généralisé par Newton la méthode d'exhaustion, d'itération et d'approximations succes sives C est, en particulier, la méthode qu'il utilise par la confection de satable des sinus dans le calcul de sin 1°, il procède par onze approximations succes sives et extrait, en cours de route, 66 racines carrées

En outre, ajoute t il, il est souhaitable de résoudre les problèmes de différentes manières, d'une part afin de s'assurer de l'exactitude des résultats et d autre part, afin de pouvoir comparer le degré de précision de ces méthodes et par suite d en choisir la plus précise Ainsi propose t il sept procédés différents pour déterminer le méridien d'un lieu et,par conséquence,la direction des quatre points cardinaux L'on voit donc là un exemple de l'effort constant de Bīrūnī en vue d'éclairer la "plage" où réside la vérité, d'en reconnaître les axes privi légiés de la circonscrire de plus en plus, d'explorer les possibles et de préciser les probables Cet effort constant l'a fait rechercher, quarante ans durant, une copie de l'ouvrage de Mané *(le livre des Secrets)* ayant eu des doutes sur une interpretation de Razès à propos d'une idée contenue dans ce livre Le hasard lui a fair avoir cette copie, à Ḫawārizm, parmi un lot d'ouvrages que lui a vendu un soldat de la region de Hamaḏān

"J'en ai éprouvé autant de joi, dit-il, qu'un homme qui a soif à la vue de l'eau "

Effort constant, persévérance, telle a été une des qualités essentielles du génie de Birūnī dans sa recherche scientifique On ne peut pas ne pas faire le parallèle avec Newton, expliquant le secret de sa découverte de la loi de la gravitation universelle en déclarant "C'est en y pensant toujours"

Pour obtenir les solutions convenables, pour éviter les erreurs et écarter les risques, on ne peut donc pas se fier uniquement aux "longues chaînes de raisons" qui prétendent avoir une validité universelle et conduire infailliblement au but Bien que champion prestigieux dans ce domaine, Birūnī pensait que pour le monde de la vie, de la société, de l'histoire, comme dans les sciences de la nature, il fallait suivie une autre voi Il fallait disposer de subtilité, de discrimination, d'agilité critique, pour comprendre comme pour agir. Il fallait s'adonner ardemment à l'experimentation "C'est l'expérience qui dégagera les lois, la connaissance des lois ne précède jamais l'expérience "

Il rejette impitoyablement le principe d'autorité ce n'est pas qu'il ne se soit attaché à prendre connaissance des travaux de ses prédécesseurs et de ses contemporains, bien au contraire il a été amené à apprendre plusieurs langues (outre l'arabe et le persan, le syriaque, le grec et le sanscrit) pour pouvoir revenir aux sources originales et éviter les erreurs consécutives aux fausses transcriptions ou interprétations Il s'y est appliqué, en particulier, dans les études d'ordre historique, social ou religieux qu'il a entreprises, "se mettant en garde, dit-il, contre les idées préconsues, les habitudes acquises, l'intolérance, la passion et la recherche des honneurs". A ce sujet, une page admirable de l'introduction de son *"Histoire de l'Inde"* mérite d'être reproduite "Les Indiens, écrit-il, n'ont pas eu, comme les Grecs, de philosophes qui aient dégagé, dans leurs ecrits, la matière purement scientifique, ils n'ont presque pas d'ouvrage qui ne soit un véritable fatras où se mêlent en vrac et en désordre, toutes sortes de croyances populaires, telles celles qui consistent à gonfler les nombres, à allonger les périodes, à étaler les opinions communes parmi les gens de leurs sectes sans admettre d'y être contredits De la sorte, l'esprit d'autorité est maître chez eux C'est pourquoi j'affirme, pour ma part, ne pouvoir comparer leurs livres de calcul et de mathématiques qu'à des pierreries mélangées a des débris de poterie, à des perles éparpillées parmi de la fiente de chameaux, à des pierres précieuses réunies avec du gravier, pour eux, les deux espèces ont une valeur équivalente, c'est qu'on ne trouve pas de cas où ils se soient attaches à établir un fait ou à fournir la démonstration d'un raisonnement Mon attitude, à moi, dans tout ce que je rapporterai à leur sujet sera celle d'un narrateur et non d'un critique, sauf en cas de nécessité trop criarde"

Cependant le travail de Birunī ne s'arrête pas là, bien au contraire, il ne fait que commencer, il soumet, par la suite les différentes idées et les notions diverses à l'analyse logique, à la vérification expérimentale Il essaie d'en établir la preuve scientifique ou, au contraire, de les infirmer Il en discute avec les savants Indiens de son temps et, traduisant pour eux, en sanscrit les Eléments d'Euclide et l'Almageste de Ptolémée, il a ainsi l'occasion de faire la synthèse de la pensée hindoue et de la science grecque

En résumé, l'oeuvre qui se crée sè fonde essentiellement sur l'observation et la ſfelexion personnelles

Rien d'étonnant alors qu'on voie fréquemment Birūnī décrire les expériences u'il entreprend, les résultats qu'il obtient, et ceux, au contraire, qu'il lui a été npossible de constater Il ne se contente pas de répéter les affirmations des spécia-stes, il les soumet toujours à des vérifications variées Souvent il est ainsi amené à nagmer de nouveaux appareils d'expérimentation, à inventer de nouveaux instru-ients de mesure Telle l'hémisphère que nous avons citée et qu'il a utilisée pour établissement des coordonnées geographiques de différentes localités Tel encore le icnomètre, encore en usage de nos jours, et qu'il a imaginé pour appliquer le principe 'Archimede à la détermination du poids specifique des principaux métaux et de ifférentes sortes de roches

Sā'd ad-Din At-Taftazānī décrit cet appreil dans son livre de théologie "*Šarḥ Al-Iaqāsid*" "Il s'agit, dit-il, d'un récipient de forme troncconique muni à sa partie ipeneure d'un déversoir coudé Abū-r-Rayhān remplit le vase d'eau, y fait tomber 'nt mātqāls d'or, par exemple, après avoir placé au dessous du déversoir le plateau une balance, il évalue ainsi le poids de l'eau déplacée Il répète l'expérience avec outes sortes de métaux et de roches Auparavant il s'est appliqué à purifier la matière inérale et l'eau qu'il a puisée dans l'Amou Daria en période d'automne Il est ıdent, ajoute-t-il, que les résultats obtenus dépendent de la nature de l'eau utilisée, la région d'où elle provient et de la température de la saison Il est à remarquer que densité est d'autant plus petite que la quantité d'eau déplacée (pour un même poids) t plus grande, et par suite le volume du corps plus important "

Les résultats sont admirables Et je ne sais ce qu'on doit admirer le plus, le ombre et la variéte des cas étudiés ou l'extrême précision qu'obtient Biruni bien qûe disposant pas des moyens perfectionnés dont nous disposons de nos jours Nous onnons ci-après un tableau des densités de différents corps, soit en assignant, comme runi, l'indice 100 à l'or pour les métaux, à l'hyacinthe pour les roches, soit en pportant ces corps à l'eau Pour pouvoir juger de la valeur des résultats de Biruni, ous ajoutons une colonne où nous faisons figurer la densité établie actuellement

Corps	Résultats de Biruni en prenat 100 pour l'our	Densité par rapport a l'eau	Actuellement
Or	100	19	19 3
Argent	54 625	10 377	10 5
Cuivre	45 666	8 676	8 9
Plomb	60 125	11 437	11 35
Bronze	46 625	8 859	
Mercure	71	13 49	13 595
Fer	41 72	7 92	7 9
Alliage tutée + Cuivre	44 875	8 52	
	Indice 100 pour l'hyacinthe		
Hyacinthe	97 125		
rouge	90 458		
Émeraude	69 5		
Lapis lazulé	67 81	3 91	3 90
Perles	65 58		
Coraline	64 75	2 50	
Cristal	62 6		
Nacre Corail	64 54		
Verre de Syrie	62 79		
	63 125		
	28		
	26 25		

La comparaison de ces nombres montre que l'erreur relative commise par Bīrunī varie entre 2.5 % et 0·3 revenons à la méthode de Bīrunī

Il arrive parfois que Bīrunī cite un fait universallement rapporté, quoique invraisemblable Son esprit critique ne lui permet pas de l'admettre, il multiplie les observations, répète les expériences, sa conviction intérieure se confirme "lorsqu'un fait est affirmé par l'opinion générale, pense-t-il, et que l'observation directe et l'expérience le contredisent, ce sont ces dernières qui doivent primer"

Ainsi, avec une pointe d'humour parle t-il de l'effet de l'émeraude sur les vipères "On est unanime à raconter, dit-il qu'à la vue de l'émeraude, les yeux de la vipère se mettent à couler, ce fait est rapporté de bouche à bouche, il est cité dans les ouvrages de spécialistes, on en fait état dans les poèmes

Cependant, et malgré l'accord unanime, l'expérience s'inscrit en faux vis-à vis de ce phénomène Je me suis appliqué a l'étudier, j'ai répété les expériences les poussant à un degré qui ne saurait être dépassé j'ai fait porter aux vipères des colliers d'émeraude, j'ai tapissé leur repaire de ces pierres, j'ai fait défiler devant leurs yeux des cordons d'émeraude durant neuf mois, par temps chaud comme par temps froid, il n'y a qu'une chose que je n'ai pas faite c'est de leur passer l'émeraude comme collyre Aucun effet pourtant n'a pu être enregistré par moi, sinon, peut être, que la vue des vipères devienne plus aigue" [3]

En minéralogie, dans l'étude des phénomènes géologiques on recontre chez Bīrunī des notations très exactes, il signale ses sources, les découvertes qui lui appartiennent en propre, et les faits qu'il n'a pas pu constater

"Une personne spécialisée dans la taille et le polissage des pierres m'a rapporté que le résiste au feu et que, chauffée graduellement dans un creuset maintenu au four, puis refroi die progressivement, cette pierre acquiert une plus grande beauté et une pureté remarquable Cependant je n'ai pas pu observer ce fait et je n'ai pas éte en mesure d'en faire l'expérience" [4]

Ailleurs, il note "Le cristal a certaines propriétés qui rappellent celles du verre, je veux parler, en particulier, de la transparence Pour la fusion, par contre, ils sont différents le verre est fusible alors que le cristal, à ma connaissance, est réfractaire Je n'ai jamais constaté, pour ce qui le concerne, un phénomène de changement d'état et mes nombreuses expériences ne m'ont pas permis d'en atteindre le point de fusion" [5]

Dans son ouvrage de géographie *Tahdid nihāyāt al amakin*" il note "Le désert d'Arabie a été occupé par une mer qui s'en est retirée On en découvre les traces lorsqu'on y fore des puits ou qu'on y creuse des bassins, on retrouve des couches de terre stratifiées, du sable, des matières mouvantes, des morceaux de poterie, des tessons de verre, des os, un ensemble de matériaux tels qu'il est impossible d'imaginer qu'ils aient pu y avoir été enfouis intentionnellement Les roches qu'on en extrait renferment des coquillages fossiles des ossements de poissons, soit intacts, soit réduits en poussière laissant un vide présentant la même forme

Les mêmes phénomènes sont observés sur la rive occidentale de la mer Caspienne Nous n'avons aucune idée sur l'epoque où ces évènements ont eu lieu"

Il n'est pas possible de passer en revue tout l'apport scientifique de Biruni Nous avons simplement cité quelques exemples significatifs susceptibles de nous présenter sa méthode et de nous indiquer l'esprit qui l'a animé dans sa recherche Dans le domaine de l'astronomie, en particulier, rappelons que dans le 3e chapitre du *"Qānūn al Mas'udi"*, Biruni expose les notions géométriques et algébriques dont on peut avoir besoin pour l'étude des astres, de leurs mouvements, de leurs distances Il donne la formule générale donnant le côté d'un polygone régulier inscrit dans un cercle en fonction du raycon, ce qui l'amène, à propos du polygone de neuf côtés, a l'équation du 3e degré

$$x^3 - 3x \pm 1 = 0$$

pour laquelle il propose trois procédés de résolution, l'un de ces procédés, qu'il utilise systématiquement dans la construction de sa tables des sinsus, est la méthode des approximations successives il obtient ainsi pour sin $40°$ la valeur 0 68404032 (actuellement 0 6428) Il calcule une valeur approximative de π qu'il trouve égal à 3 1417466

Après les Banū Šākir qui, pour la mesure du degré terrestre, ont procédé par des triangulations répétées, Biruni découvre, pour vérifier cette mesure, un nouveau procédé, connu encore sous son nom il se base sur la considération de la dépression de l'horizon sensible et de sa variation au fur et à mesure qu'on s'élève par rapport au niveau de la mer il met en pratique sa méthode, effectuant ses observations sur une haute montagne de l'Inde, dominant la mer, la dépression qu'il mesure vaut 34'

Si h est la hauteur de la montagne, ε la dépression de l'horizon, x le rayon de la terre, Biruni établit entre ces grandeurs la relation $x = \frac{h\cos\varepsilon}{1-\cos\varepsilon}$

Pour l'évaluation de la hauteur h, il vise le sommet de la montagne à deux endroits A et B situés à une distance d l'un de l'autre, si x et B sont les angles de visée obtenus, Biruni établit que

$$h = \frac{d\,tgx\ tg\beta}{tg\beta - tgx}$$

Ainsi donc, l'activité de Biruni a embrassé tous les domaines scientifiques, son génie a atteint l'universalité. Il a marqué toute ce quil a touché du sceau de l'exactitude, de la précision, de la réflexion profonde et sérieuse. "Biruni a été la plus grande intelligence de l'histoire" écrit Sachau. "Il est impossible, pense un autre historien des sciences, qu'une recherche quelconque dans le domaine de l'histoire, de la géographie, de l'astronomie, des mathématiques, soit complète, si l'on manque de signaler l'oeuvre de ce savant de génie".

La fin du Xe s. et la première moitié du XIe s. ont connu dans le monde arabo-musulman, un développement intellectuel des plus puissants et une floraison des plus remarquables d'écrivains, dans le domaines de la production littéraire et scientifique; pour ne citer que les noms les plus célèbres, nous noterons ceux d'*Ibn Ǧinni*, de Zaǧǧāǧ dans les études linguistiques et philologiques, de Mutanabbi, d'Abu Firās en poésie, de Badi 'az-Zamān al-Hamadāni dans les belles lettres, de Muqaddisi, de Bakri, d'Ibn Ḥawqal, de Mas'udi en géographie, de Tabari en histoire, de Farabi, d'Ibn Sina, Ibn al-Hayṯam, Battani, Buzǧāni dans le domaine de l'astronomie, des mathématiques, de la médecine et des sciences de la nature. Cependant, pour caractériser cette période et indiquet le modèle qui la représente, George Sarton désigne la première moitié du XIe s. sous le nom de "Siècle d'Al-Biruni". C'est que la personnalité de Birunī, comme nous l'avons indiqué, est écrasante. En vérité, son courage intellectuel, sa soif de connaître, son amour de la vérité, son extrême tolérance, toutes ces qualités de son esprit scientifique n'ont pas de pareilles à son époque. C'est le Génie créateur, qui aime se sentir créer, et qui embrasse l'Univers d'une vue générable et profonde. Sous les aspects divers, il a essayé d'atteindre le Principe unique. Parmi les nations distinctes, il s'est attaché a comprendre et à définir la mesure de l'Homme. Se perdant dans l'âme du monde, il a retrouvé sa propre dimension universelle. Biruni n'est pas un savant du XIes, il vit encore parmi nous. Par gratitude, ou avec une arrière pensée d'annexion, plusieurs pays ont commémoré prématurément, le millénaire de Biruni: l'Académie des Sciences Soviétique en 1950, la Société Khaldounia de Tunis le 10 septembre 1949, l'Inde en 1951. Cependant Biruni - et c'est ce qu'il a voulu: n'est ni Iranien, ni Indien, ni Russe, ni Arabe - C'est le véritable prototype de l'homme. C'est l'Etre Supérieur qui s'est fait Homme -

Tel est, en fait, le message de Biruni à l'Humanité entière, et, comme cela a eu lieu un certain nombre de fois dans l'histoire, ce message n'a pas été compris. Déjà dans le Moyen Age occidental, Biruni a été contesté, il a paru difficile, ésotérique. De là à prétendre que cet éminent savant n'employait un langage fermé, hors de la portée du commun, que pour cacher le vide de son contenu, il n'y a qu'un pas - C'est pourquoi une déformation de son nom, rapportée par une fable de la Fontaine faisait nommer Maître Aliboron toute personne ignare, et par suite un âne.

Mais n'est ce pas là le sort de toutes les grandes oeuvres créées par l'esprit humain?

A regret, nous sommes obligés de quitter la personnalité attachante de Biruni- il est temps, pour nous de conclure Abul 'Alà al Ma'arri parlant du temps le compare à un long poème dans lequel la rime, le mètre et le rythme ne varient pas, bien que le même mot qui rime ne soit jamais répété Ibn Haldūn écrit, d'autre part, "Le passé ressemble à l'avenir plus encore que l'eau ne ressemble à l'eau"

Dans la ronde des nations,le Monde dit Occidental a dépassé aujourd'hui ceux qui avaient devancé de plusieurs siècles ses propres recherches Mais aurait il tant fait, s'il n'avait profité de leur effort?

Et si nous nous penchions un peu plus sur les oeuvres de ces derniers pour essayer d'apporter plus de clarté à leur pensée, pour unir en fait nos efforts aux leurs, notre idéal au leur n'est ce pas là une marque de solidarité humaine, une juste récompense de ce qu'ils nous ont légué, n'est ce pas là le tribut de reconnaissance que nous leur devons? D'autre part, n'est il pas temps que la Nation musulmane entre de nouveau dans l'arène et tende de nouveau la main au Monde moderne pour participer à la farandole fantastique de l'Esprit Humain?

Et sur la carrière où bien des peuples se succèdent, l'union des esprits, la tension toujours plus forte à maintenir la chaîne non rompue, n'est ce pas là le fruit d'une conviction ferme que l Humanité est Une, et que les Nations se passent l'une à l'autre le flambeau pour que toujours et sans discontinuité soit éclatant le prestige de l'Humain?

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NOTES

1 On pourra comparer cet usage avec le parler Tunisien actuel barrānī = de l extérieur étranger

2 ed Beyrouth 1957 tome III p 29

3 Al Ǧamāhir fī ma rifat al ǧawāhir p 167 Hayderabad 1355 H

4 *op cit* p 82

5 *op cit* p 185

فحسب لا يشم رائحة الترجمة ، بل يحسب أنّ الأصل عربي وأن
كاتبه عربي أيضا

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وبعد ، فإنّ من النادر أن نجد من علماء المسلمين غير العرب من أحب العربية ودافع عنها كالبيروني ، أو اطلع عليها وتمكّن منها ، أو كتب بها في موضوعات علمية بحتة متنوعة مختلفة كما كتب هو ، وكان في كل ما كتب عربيا ما فيه عجمة أو ركاكة أو مخالفة لأساليب العرب ، بل كان إلى ذلك كله من أئمة اللغة وأدبائها . كان البيروني نسيج وحده ، ولم يلحق به أحد في جميع العصور الاسلامية

بيروت — صلاح الدين المنجد

كفروا إنْ هذا إلاّ سحرٌ مُبين) جعلنا الله من تابعي الحق وناصريه ، وقامعي الباطل ومظهريه (الآثار ص٦٨)

وهناك مئات من الامثلة التي يمكن ان نسوقها دليلا على قوة اسلوب البيروني ، لكن المقام لا يتسع هنا .

ويجب ان ننسى ان معرفة البيروني للغة هي التي مكنته من التعبير بها عن مدلولات علوم كثيرة لا عهد للعرب بها ، فقد كتب في الرياضيات والفلك والتنجيم والصيدلة والتاريخ والجغرافيا والمعادن والنبات والرياضيات والهندسة والطبيعيات والكيمياء وغيرها ، وهذه علوم ما كتب العرب بها ، ومع ذلك فقد كانت كتاباته فيها واضحة سهلة ، فكأنما كانت الفاظ اللغة أمام عينيه ينتقي منها ما يلائم المعنى ، فاسلوبه في هذه العلوم سهل واضح ، ومن الطبيعي ان لا يكون اسلوبه هنا كاسلوبه الانشائي الذي يخضع لقوانين الفصاحة والبلاغة العربية

وحتى في كتاباته المنقولة الى اللغة العربية نراه يصنع ترجماته بأسلوب عربيّ فهذا كتاب باتنجل الذي نقله من الهندية نجد فيه من العبارات ما تحسبه انه لكاتب عربي محض ، استمع اليه

" قال السائل كيف الطريق الى الرتبة المطلوبة لمن هو متخلّف لم يبلغها بعد ، وكيف العَوْدُ اليها لمن هو ساقط عنها بزلّة كانت منه فيها ؟
قال المجيب : لو لم يذهب قلب ذي الزلّة شَعاعاً (مرأها ريثّ خطا" شعاعا) لما احتطّ عما فارسه من السعادة فأمّا سبيلُ بلوغها للمجتهد ، والعوْد اليها للمخطي " ، فيكون بمواصلة العبادات ، وإتعاب البدن ، بما يحصل به الأجْرُ والثواب من الصوم والصلاة والتسابيح والقراءات ، وكل ما يُقصد به ذات الله تعالى و يُتقرّب به اليه "
(A C)

فقد ذكر ياقوت أنّ للبيروني شرحاً لشعر أبي تمام ، وقال : رأيت نُسخه بخطه (معجم الأدباء ١٧ / ١٨٦) ، وليس أبو تمام بالشاعر السهل ، ومن المؤسف أن هذا الكتاب لم يصل إلينا ، وذكر أيضا أن له كتابا اسمه " مختار الأشعار والآثار " ونعلم أن البيروني كان أيضا شاعرا وقد أورد له الصفدي – وهو أديب ناقد – قصيدة مدح بها أبا الفتح البُستي نقلها من ياقوت ، وقال : ويا عجبا كل العجب من نظم هذا الرجل هذا النظم إذ ليس هذا فنه ، ولا عُرف به ، فهذا شعر جيد (الوافي ٨/ ١٤٢) وكان ياقوت بيّن أنه ذكره في معجمه " لأن الرجل كان أديبا أُريبا لغويا " (١٧ / ١٨٥)

نأتي الآن إلى أمر أخير نحب إيضاحه لقد زعم سخاو – وهو مستشرق لم يكتب في العربية أي كتاب – زعم أن أسلوب البيروني العربي ركيك وهذا جهل من سخاو ، يدل عليه كتابات البيروني نفسه ، فعندما نقرأ له نلمس في أسلوبه مسحة من الفصاحة والبيان لنستمع إليه

" فقلت له يا عافاك الله ! وهل خاطبَنا اللهُ ورسوله إلا باللغة المتعارف بها بين العرب ؟ وإنما نبيك ومن لغته العربيون أُتّخذ ، بل اتخذ من علم الشريعة فعزل عنها وارجع إلى علماء الهيئة فهم بأسرهم يخالفونك في تماميّة شهر رمضان ، ويزعمون أن الفَلَك والنيّرين لا يميّزان شهر رمضان من الشهور فيخصّانه بسرعة في حركاتها أو بطءٍ فيها ، ولكنّ الكلام مع المُصّر عنادا ، والمتخطي جهلا غير مُجدٍ على القاصد والمقصود ، قال الله تعالى : (وإن يروا كِسْفاً من السماء ساقطاً يقولوا سحابٌ مركوم ، ولو أنزلنا عليك كتاباً في قرطاس فلمسوه بأيديهم لقال الذين

(A C)

حُمُرٌ مُسْتَنْفِرَة ، فَرَّتْ مِن قَسْوَرة) وماذا عساهم يقولون في آثار العظام الموجودة الآن في البيوت المحفورة في صم الصخور في جبال مدين ، والقبور المنحوتة فيها ، والعظام المدفونة في أجوافها كعظام الإبل كبرا أو أعظم (الآثار ١٤)

فانظر ما احسن استشهاده بالاية القرآنية (كأنهم حُمُرٌ مستنفرة)

ويورد مثالا ثانيا فهو يتكلم على ما ورد في التوراة من قول ايشعيا النبي يقول :

" ارى راكب حمار و راكب بعير ، وأقبل احدهما يهتف ويقول : هوت بابل وتكسرت اوثانها المنحوتة بال وهذه بشارة بالمسيح راكب الحمار ومحمد راكب البعير الذي بظهوره هوت بابل وتكسرت أصنامها وتزلزلت قصورها وباد ملكها لكن يدعوهم الإصرار على الباطل الى الافتراء بادعاء ما لم يتعارف به الخلق من أن راكب البعير هو موسى لا محمد وما لموسى وأشياعه وبابل ، وهل ظهر له أو لقومه بعده ما ظهر لمحمد ولأصحابه فيها ، كلا ، لو نحوا من أهلها رأسا برأس لرضوا من الغنيمة بالإياب ثم يمضي قوله مستشهدا بالآية القرآنية (ولو فتحنا عليهم بابا من السماء فظلوا فيه يعرجون لقالوا إنما سُكرت أبصارنا بل نحن قوم مسحورون ، لا بل هم عن الحق عمون) (الآثار ص ٢٩)

وكثيرا ما نراه يستشهد بالأمثال العربية القديمة وبأقوال العرب المأثورة لتأييد اقواله او تسبيحاته ، مما يطول ايراده هنا وكل ما ذكرنا يدل على ان البيروني كان يعرف العربية معرفة واسعة جيدة

ونعتقد ان هذه المعرفة هي التي مكنته من شرح أشعار العرب

(A C)

واذا كانت طبيعة ألفاظ كتاب الصيدنة قد تجبره على الاستشهاد بالشعر، فإننا نجده في الآثار الباقية يستشهد على الحوادث التاريخية في الجاهلية بأشعار العرب، لأن الشعر هو ديوان العرب فيه تاريخهم ففي كلامه على فصل ما بين سنة العرب وسنة الشمس ومن يصطنعه قال :

ويتولى ذلك النساءة من كنانة المعروفون بالقلامس واحدهم قِلَمّس، وهو البحر العزيز وأول مَنْ فعل ذلك منهم حُذَيْفة، وهو ابن عدي بن فقيم بن عدي وآخر مَنْ فعله ابو ثمامة جنادة قال شاعرهم :

فذا فُقَيْمٌ كان يُدعى القلمسا
وكان للذين لهم نوءٌ نَسَا
مستمعا من قوله مُرَاءٍ سا
مسحّراً من سابقي كنانة
(الآثار ص١٢)

وثمة أمر آخر يدعو الى الاعجاب عند البيروني، ويدل على تمكنه من اللغة عن طريق حفظه القرآن الكريم واستشهاده دائما بآياته فكأنما وُضعت الآيات أمامه فهو يختار منها للاستشهاد ما يوافق المطلوب وقد ذكر ياقوت ان البيروني صنّف للسلطان مسعود كتابه في لوازم الحركتين، وقال : وهو كتاب جليل لا مزيد عليه، مقتبس أكثر كلماته عن آياتٍ من كتاب الله عز وجل (معجم الادباء ١٧ / ١٨٥)

فمن استشهاداته البارعة قوله عن المعاندين الذين ينكرون ما كان عليه بعض الامم البائدة من بسطة الاجسام وعظمها، قال :
" يهربون من قبول الحجج الدوامغ كأنهم

(A C)

كأسه كعطر العطار من بيته

وقال ابو نواس

فهما مدام كعين الديك صافية

من مسك دارين فيها نفحة الفار

وقال الاخر

فتنا كأنا بيتنا لطيمة

من المسك او دارية وعيابها

وقال ابن الرومي

يعال كثبانة والعنبر

ومسك داريكم الأذفر

وقال النابغة الجعدى في خمر يصفها :

البعض منها فلجان من مسك دا

رين وفلج من فلفل ضرم

وقال آخر :

اذا التاجر الداري جاء بفارة

من المسك راحت في مفارقهم تجرى

والفلج مكيال عرب من السريانية ، وهو بالعربية اى

القاسم ، ومنه الكر الفالج بالسواد وقال للملاح

والنوتى دارى ، لأنه مع صاحب العطر في مركب

ورودهما معا ، لا انه صادر من جزيرة منها ، بهذا

الاسم " اهـ (الفصل الاول من الصيدنة)

ففي هذا النص القصير نراه يدلل على سعة حفظ على كثير من الناس

، ونراه يستشهد بشعر للنابغة الجعدي وكثير والأحوص والعجاج وابن

الرومي وابي نواس وآخرين ، مما يدل على تمكنه من اللغة العربية

، وسعة اطلاعه على اشعار العرب وحفظه لها وجودة استشهاده بها

(٩ C)

العطار عند العرب بالدارى ، نسبةً الى تلك الفرضة ، كمـــا نُسب العطر اليها ايضا . وجاء في الاثر : مَثَلُ الجليس الصالح كمَثَلِ الدارىّ ، إلاّ يحذك من عطره يعبقك من ريحه . ومَثَلُ الجليس السوء كمَثَلِ الكِيْر إلاّ يحرقك بشرره يؤذك بدخانه ».

" وأشعار العرب تنطق بنسبة المسك الى دارين فتوهم تلك الفرضة ، والى الدارى فتوهم العطار ، وتسميه البلد بالهند او جزيرة دارين هو تخريج لا حقيقة له .

قال النابغة الجعدى :

رحيقاً عراقياً وريطاً يمانيا
ومحتبطاً من مِسْك دارينَ أذفرا

بأصداف هنديّين ربّ لحا هما
يبيعان في دارين مسكا وعنبرا

وقد أصبح بأن دارين فرضة ، وَرَدّها الهنديّان .

وقال كثير

مساج مَوْدّى رأسها مشمعلّة
جرى مسك دارين الأحمّ حلالها

وقال الأحوص

كأنّ فارة مِسْكٍ مفتّحاتها
صهباء ذاكية من مسك دارين

وقال الفحّاح يصف كناس ظبي :

شواء عطارين بالعطور
أصنافها والمسك والكافور

فأتبع دارين بعطارين ، أي أنّ نحر هذا الظبي في

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النحو بالعربية على المدح بالفارسية ، وهذا اعظم ثناء على اللغة العربية

— ٢ —

هل اتقن البيروني اللغة العربية التي فضّلها ؟

ان المتتبّع لتواليف البيروني يلاحظ سرعة اطلاعه الواسع على اشعارها و أمثالها وأخبار العرب في الجاهلية ، ويُدهشه كثرة الاستشهاد بالشعراء جميعا من جاهليين وإسلاميين وعباسيين على معاني الألفاظ التي يذكرها والامثلة على ذلك كثيرة جدا ، لا نستطيع الاطناب في ايرادها في هذا البحث ، لكننا نقدم بعض الامثلة

ففي الفصل الاول من كتاب الصيدنة سوف بحثا عن سبب النسبة الى بعض الاماكن فيقول :

وتجار السلع المجلوبة من شواسع البلاد وأُقاصي الجزائر والسواحل ، ينسبون إمّا الى الامتعة التي يتبايعون بها وإمّا الى المعادن التي يجلبونها منها ، وإمّا الى سموت طرقهم التي جازوا منها ، وإمّا الى الفُرَض التي أرفأوا اليها ، وذلك كالعنبريّ لبيّاعه ، والمسكيّ لشاريه ، وكالسلاهطي والبحريّ في تاجر العنبر ، والهندي والتبّتي لجالب المسك ، والشرقي والغربي إذا طرق من سَمْتيهما ، وكالخطّي من الرماح نسبة الى القرى التي بين بحار أرض عُمان وبين أرض الشِحْر ، فإنها فُرَضٌ متوالية على الساحل كهيئة الخط ومنها دارين مرفأ السفن الحاملة في قديم الزمان العطر والطيب ، ثم يشتريها العطارون من اهل البوادي ومَنْ هم بأسهُ له كقريش المخصوصين بالحذق في خلطها وتركيبها والاتجار بها كحذق أهل اليمامة بعمل الأدهان ولهذا اشتهر

(A C)

أحبّ إليّ من المدح بالفارسية . وسيعرف مصداق قولي من تأمل كتاب علم قد نُقل الى الفارسي كيف ذهب رونقه ، وكُسف باله ، واسودّ وجهه ، وزال الانتفاع به ، اذ لا تصلح هذه اللغة الا للأخبار الكسروية والأسمار الليلية .

ان هذا النص الهام يدلنا على امور كثيرة :

١ ـ فهو يوضح بشكل مُبين ميله للعروبة والإسلام ، خلافا لما ذكره سخاو في مقدمته لآثار البيروني (ص) أنه كان متعصبا لقوميته الفارسية وقد تابعه على ذلك من المعاصرين فيليب حتى فزعم انه كان مناصراً للشعوبية ، دون ان يطلع على جميع مؤلفاته (تاريخ العرب المطول ص ٤٨٨)

٢ ـ وهو يذكر إخفاق الفئات الفارسية القومية من الجيل والديلم الذين حاولوا تقويض الحكم العربي الاسلامي ، لا سيما " جلابيب العُجمة " لأن القرآن العربي موجود ، ودعوة الاسلام تقرع آذانهم بالعربية كل يوم خمس مرات

٣ ـ وهو يُظهر محاسن العربية ، فلا يتمسك بسبب ديني مثلاً ، ولا اتباعا لحديث رسول الله صلى الله عليه وسلم " احبوا العرب لثلاث لأني عربي والقرآن عربي ، وكلام اهل الجنة عربي " وهو حديث صحيح او حسن رواه ابن عباس (انظر كتاب القرب في محبة العرب) ـ بل لأن هذه اللغة استطاعت بسعتها ومرونتها وقابليتها أنْ يُنقل اليها العلوم من أقطار الارض ، وهذه شهادة هامة لأنها صادرة عن عالم يحكّم عقله ، وغير عربي مُلزم بحب العربية

٤ ـ وهو يهزأ باللغة الخوارزمية ويرى انه مستغرب ان يخلد فيها اى علم ، ويرى ان الفارسية تصلح للأخبار الكسروية والاسمار الليلية ، ويفضل

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واليونانية ، والفارسي عدة لغات منها العربية والفارسية والهندية والعبرانية والسريانية وغيرها فقد ولد في خوارزم سنة ٣٦٢ هـ ، ثم رحل عنها اوعاش في ضواحيها منتمي الروسي . وتعلم في صغره اللغة الخوارزمية ، وهي لهجة من لهجات الفارسية ، وكان لها حظ خاص بها ، اباد قتيبة بن مسلم الذين كانوا يعلمونه ويحسبونه (الاثار ٣٦ ، ٢) ، فوجد امامه لغتين الفارسية ، والعربية فماذا كان موقفه منهما ورأيه فيهما ؟

يفصح لنا البيروني عن ذلك في كتاب من اجل كتبه هو الصيدنة ، فيقول في الفصل الرابع منه :

دينا والدولة عربيان وتوأمان ، ترفرف على احدهما القوة الالهية ، وعلى الآخر اليد السماوية وكم احتشد طوائف من التوابع ، وخاصة منهم الجيل والديلم ، في لباس الدولة جلابيب العجمة ، فلم يتفق لهم في المراد سوق وما دام الاذان يقرع آذانهم كل يوم خمسا وتقام الصلوات بالقرآن العربي المبين خلف الأئمة صفا صفا ، ويخطب لهم في الجوامع بالاصلاح ، كانوا لليدين والفم وحبل الاسلام غير منفصم ، وحصنه غير منثلم والى لسان العرب نقلت العلوم من أقطار العالم فازدانت وحلت في الأفئدة ، و سرت محاسن اللغة منها في الشرايين والأوردة ، وإن كانت كل امة تستحلي لغتها التي الفتها واعتادتها واستعملتها في مآربها مع الأفها وأشكالها ، وأقيس هذا بنفسي ، وهي مطبوعة على لغة لو خلد بها علم لا ستغرب استغراب البعير على الميزاب ، والزرافة في الجراب ، ثم منتقلة الى العربية والفارسية ، فأنا في كل واحدة دخيل ، ولها متكلف والهجو بالعربية

(٨ ح)

البيروني و اللغة العربية

للدكتور صلاح الدين المنجد

انتشرت اللغةُ العربيةُ في البلاد التي فتحها العرب بدخول الاسلام فيها وانتشاره بين اهلها ، لأنّ العربيه هي لغة الاسلام وأُنزل القرآن الكريم بها ، فكان لزاماً على كل مسلم ان يقرأ القرآنَ و يتعلّم العربية

كان اسلام البلاد المفتوحة يحقّق أمرين : الاول نشر العقيدة الاسلامية التي جاء بها القرآن ، والثاني نشر ثقافة جديدة تقوم على القرآن والعربية ، مما أدّى الى تعريب الاقوام المسمّى بالأعاجم ، الذين لم ينحدروا من اصل غير عربي ، حتى اهل الذمة اضطروا الى تعلّم العربية لأنها لغة الدولة ، لذلك انتشرت العربية بين هؤلاء الاقوام ، على اختلاف اجناسهم وأديانهم السابقة فأصبحت لغتهم التي يتكلمون ويكتبون و يؤلفون بها .

وكانت اللغة الفارسيه من اللغات التي دثرتها اللغة العربيه وحلّت محلها فأصبح ابناء فارس وما وراء النهر يعرفون العربيه احيانا اكثر من معرفتهم لغتهم او لهجتهم الاولى ولما ازدهرت الحضارة الاسلامية اصبحت اللغة العربية لغةَ علم وحضارة ، فاحتوت جميع علوم اليونان والفرس والهند ، على أيدي النَقَلة والمترجمين ، فكانت لغة العالم المتحضّر في القرون الوسطى .

وقد مهر كثيرون من أبناء فارس وما جاورها باللغة العربية فكتبوا اثارا ادبية و علمية و تاريخية ولغوية وفقهيه تُعتبر من روائع التراث الاسلامي ومن هؤلاء ابو الريحان محمد بن احمد البيروني الخوارزمي ، احد نوادر العقل البشري وكبار المشاركين في الثقافات الاسلامية والفارسية والهندية

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المـــراجـــع

(١) راجع مثلا ما قاله ابن سينا عن نشأته فى ابن ابى اصيبعة . عيون الانباء فى طبقات الاطباء ج ٣ (دار الفكر بيروت ١٩٥٦) ص ٣ - ٤

(٢) الشحات علي احمد ابو الريحان البيروني (دار المعارف بمصر ١٩٦٨) ص ٤٦ - ٤

(٣) راجع مثلا فى البيهقى ابو الفضل تاريخ البيهقى (القاهرة ١٩٥٦) ترجمة يحيى الخشاب اشاره الى احد كتب البيروني " الادب والفضل والهندسة والفلسفه " والمناسبة من كتاب البيروني "المسامره فى اخبار خوارزم" ص ٤ ٣ ٣ وما بعد هنا -

(٤) راجع "رساله افراد المقال فى امر الظلال" (ط ١ جمعيه دائره المعارف العثمانية حيد آباد الدكن ١٩٤٨) ص ٣٢ حيث يقول "و هو راى العرب و عليه العمل فى كتاب المجسطى".

(٥) Nizām 'd Din, M Al-Birūni ɔnd his Magnum Cpus al-Qanūn al-Mas'ūdi, in ɾl-Qanūn al-Mas'ūdi (Hyderabad - Dn, India 1954) p i

(٦) Guillaume, Alfred, 'Preface', in Arnold, Sir Thomas and Guillaume, Alfred Legacy of Islam (London, 1931) p vi Translated into rabic (Cairo, 1936) p n

(٧) كراتشكوفسكى، اغناطيوس تاريخ الادب الجغرافى العربى ترجمه صلاح الدين عثمان هاشم القسم الاول (القاهره ١٩٥٤) ص ٢٥١

(٨) شحاته الكتاب السابق ص ٤٣

(٩) كراتشكوفسكى ص ٢٥٢

(١٠) الترجمه العربيه لمقال روزنتال The Technique of Muslim Scholarship (مصر ١٩٦٣ م)

(١١) الشحات . ابو الريحان البيروني ص ٦٩

(١٢) رساله فى استخراج الاوتار والدائره (ط ١ جمعيه دائره المعارف العثمانيه حيدرآباد الدكن ١٩٤٨) ص ٩٦

(١٣) ابن ابى اصيبعة الكتاب السابق ص ٦

(١٤) Rosenthal, F The Technique of Muslim Scholarship(1947) p. 18.

(١٥) الرومى، ياقوت بن عبد الله معجم الادباء ج ١٤ (القاهرة ١٩٣٦) ص ١٨٢

(١٦) الشحات الكتاب السابق ص ٦٩ اشاره البيهقى الوارده هنا فى تاريخ البيهقى ص ٣٤

" وأما بباهة قدره وجلالة خطره عند الملوك ، فقد بلغ من حظوته لديهم أن شمس المعالي قابوس بن وشمكير أمير جرجان أراد أن يستخلصه لصحبته ، ويرتبطه في داره ، على أن تكون له الامرة المطاعة في جميع ما يحويه ملكه ، ويشتمل عليه ملكه ، فأبى عليه ، ولم يطاوعه . ولما سمحت قرونته بمثل ذلك ، أسكنه في داره ، وأنزله معه في قصره ." (١٥)

ولم تكد تمضي سنتان على قدوم البيروني الى جرجان (١٠٠٠ م) حتى كان قد أهدى للامير كتابه الآثار الباقية من القرون الخالية .

وبعد عودة البيروني الى موطنه خوارزم على أثر قيام ثورة عسكرية أطاحت بعرش الامير شمس المعالي نال حظوة كبيرة لدى الامير أبي العباس المأمون فقد :

" أصبحت له عند هذا الامير الحظوة التي ما بعدها حظوة ، والقدر الذي لا يدانيه قدر ، اذ عرف الامير للعالم مكانته من العلم ، فاتخذه مستشارا له ، وأسكنه معه في قصره ، وكان يبدي له مظاهر الاحترام والتقدير ويثبت ذلك من عبارة البيهقي التي نقلها عن كتاب البيروني المسامرة في أخبار خوارزم اذ يقول انه قضى سبع سنين في خدمة أبي العباس المأمون بن محمد آخر أمراء دولة المأمونيين ." (١٦)

* * *

وان كان هناك ما نستنتجه من هذا كله فهو أن البيروني مدين لثقافة عصره بمقدار ما تدين له الثقافة الاسلامية من اسهامات أصيلة .

عليهم الاموال والهدايا ، كما تنافسوا في اقتناء المخطوطات التي كانت خير عون للعلماء على البحث والتنقيب . وأسس بعض هؤلاء كالفاطميين والسامانيين مكتبات ضخمة منها مكتبة نوح بن منصور الساماني سلطان بخارى التي وصفها ابن سينا بقوله :

" فسألته أي السلطان يوما الاذن في دخول دار كتبهم ومطالعتها ، وقراءة ما فيها من كتب الطب . فأذن لي فدخلت دارا ذات بيوت كثيرة في كل بيت صناديق كتب منضدة بعضها على بعض ، في بيت منها باللغة العربية والشعر ، وفي آخر الفقه ، وكذلك في كل بيت كتب علم مفرد . فطالعت فهرست كتب الاوائل وطلبت ما احتجت اليه منها ، ورأيت من الكتب ما لم يقع اسمه الى كثير من الناس قط ، وما كنت رأيته من قبل ولا رأيته أيضا من بعد " (١٣)

ومن المستبعد أن يتصور المرء عالما كالبيروني يقضي أكثر من أربعين سنة وهو يفتش عن نسخة من كتاب ماني في سفر الاسرار الى أن وفق أخيرا في الحصول عليه (١٤) ، ثم تفوته الاستفادة من مكتبة عامرة كمكتبة السامانيين في بخارى .

وكان البيروني من العلماء الذين استفادوا من تنافس الحكام والامراء المسلمين على رعاية العلماء واستقدامهم الى بلاطاتهم ويبدو أنه ظفر خلال نشأته وقبل سفره الى جرجان لا برعاية الاسرة الحاكمة المحلية في خوارزم فحسب ، بل وبرعاية السامانيين أيضا وفي هذه الاثناء استلفتت مكانة البيروني العلمية شمس المعالي قابوس بن وشمكير أمير جرجان ، فدعاه الى عاصمته وتردد البيروني في اول الامر ولكنه لم يلبث أن قبل الدعوة . ويقول ياقوت في هذا الصدد :

ولعل قيام العلماء والمثقفين العرب بترجمة جميع أو أكثر العلوم اليونانية التي كانت في متناولهم هو الذي دفع البيروني الى التحول الى دراسة الثقافة الهندية ويرى الاستاذ السحات أن " الاتصال الوثيق بين البيروني وابن سينا الذي تقدر مدته بنحو من عشرين سنة بين بخارى وخوارزم وجرجان حمل البيروني يطلب كنوز الحكمة والعلم في الشرق الاقصى بعد افتقار العلم عند اليونان وقصور الحكمة عند حكمائهم " (١١)

وأفاد البيروني مثل غيره من طلبة العلم المسلمين من التعليم الخصوصي من أساطين العلم وجهابذته . وممن تلقى عنهم البيروني هذا النوع من التعليم والرعاية في الوقت ذاته أحد أفراد الاسرة الحاكمة في خوارزم ، وهو أبو نصر منصور بن علي بن عراق العالم الفلكي والرياضي الذي ينسب اليه البيروني كتاب المجسطي الشاهي (١٢) ويرجع الى أبي نصر فضل غرس حب الدراسة العلمية في نفس البيروني . وفي جرجان تتلمذ على الطبيب والفلكي والعالم الرياضي أبي سهل عيسى المسيحي .

ويمكن القول بان أسلوب التعليم الخصوصي وما كان يتيحه من مشاركة في العمل بين التلميذ والمعلم في الدراسة والتأليف أسهم اسهاما صحيحا في تدريب الطلبة على البحث والكتابة والنقد . ولا ريب كذلك في أنه كان عاملا من العوامل المهمة التي جعلت من الممكن تصنيف تلك الكتب الضخمة التي صنعها المسلمون في شتى فروع المعرفة .

ووجد العلماء من أمثال البيروني تشجيعا نادر المثال في بلاطات الاسر الاسلامية الحاكمة في المشرق والمغرب ، مستقلة كانت أو شبه مستقلة . فقد تنافس الحكام على استقدام العلماء والمؤرخين والفقهاء والشعراء الى عواصمهم ، وأغدقوا

وبالرغم من أن البيروني لم يكن عربيا فقد فضل الكتابة بها لانها اللغة الوحيدة الحديرة ، كما رآها ، بان تكون لغة العلم (٧)

ويقول البيروني في هذا : " الهجو بالعربية أحب الي من المدح بالفارسية ." (٨)، ويضيف الى هذا قوله : " وسيعرف مصداق قولي من تأمل كتاب علم قد نقل الى الفارسي كيف ذهب رونقه، وكسف باله ، واسود وجهه ، وزال الانتفاع به اذ لا تصلح هذه اللغة الا للاخبار الكسروية والاسمار الليلية ." (٩)

وغني عن القول ان البيروني أفاد من جهود من سبقه من العلماء المسلمين في تقييم العلم اليوناني والتنبيه الى أخطاء العلماء اليونان ومحاولة تصحيحها في ضوء المعلومات والتفسيرات الحديدة .

وقد سار البيروني في خطى هؤلاء العلماء ، ولكنه في الوقت ذاته يكشف عن نزاهة عظيمة فيدافع عن العلماء اليونان حيثما يكون الدفاع في موضعه . ويعلق الاستاذ روزنتال على هذا بقوله :

" فان البيروني مثلا ينتقد جالينوس لتصديقه خبر ملكة الحيات التي اذا رآها أحد أو سمع فحيحها مات على الاثر . ولكن البيروني الذي ينتقد جالينوس يدافع عنه في مكان آخر عندما تعرض للنقد في معرفته الفلكيه ، وذلك عندما اعترض سنان بن ثابت بن قره على نظرية جالينوس التي يقول فيها ان اختلاف مواقع النجوم لا يمكن مراقبته الا خلال فترة طويلة من الزمن . وعندما يشير البيروني الى هذا الانتقاد الذي انتقد به سنان جالينوس يقول ان جالينوس على صواب في هذه القضية ! " (١٠)

آراء ما يبوف على ثمانية وعسرين عالما عالبيتهم من العرب . ويشير هو الى هـــــدا بقوله :

" فأما كثرة الطرق فسبب جمعي اياها تدريب المتعلم بتنوعها ثم اتحادها ، ولانها كانت لي في الغربة مؤنسة ولاسامر من فارقتهم من الاصدقاء . وقد أثبتها لك لتتأملها وتعرف كيف مـــآل جميعها الى الكتة الواحدة ، وما تثمر العوائد في العاقبة ."

ويفصل هؤلاء العلماء وعبرهم جاء القانون غنيا بموضوعاته وساملا لابحارات علماء المسرق مع اسارات الى ابحارات أهل المغرب (٤)

" فلم يقم عالم غيره ، قبله ولا بعده ، بدراسة تجمع كل ما كان متوافرا في عصره من المراجع الهندية واليونانية والاسلامية ، وفـــي الوقت داته لم يترك لنا غيره دلك القدر العظيم من الاسهامـــات الاصيلة في عدد كبير من حقول العلم (٥)

والبيروني مدين كدلك للاجيال السابقة من الكتاب والعلماء الدين قاموا بجهد ساق في سبيل تطويع اللغة العربية لتكون لغة فكر وعلم . ويسير الى هدا ألفـــرد جيوم بقوله :

" وكان من حسن حظ الاسلام أن بلغت رسالته في وقت كان فيه اللسان العربي في دروة مجده ، وكانت اللغة الآرية في فقـــر مدقع ادا قورنت باللغة العربية ، كما لم تكن اللغة العربيـــــة المأثورة في عصرها الذهبي لتقوى على منافسة هذه اللغة العربيـة في مرونتها العجيبة . فمن منابعها الاصلية استطاع الناطقـــون بالضاد ان يصنعوا بطريق الاستقاق ألفاظا دقيقة تعبر عـــن مصطلحاتها أدق تعبير لما يتطلبه الجديد من الفنون والعلوم (٧)

بعض جوانب من ثقافة البيروني

الدكتور محمود يوسف زايد - بيروت

بالرغم من المكانة الكبيرة التي يحتلها أبو الريحان البيروني في تاريخ العلم، فان ما لدينا من معلومات عن نشأته الاولى والثقافة التي تلقاها قليلة جدا بالقياس الى ما يجده المرء عن عدد لا يستهان به من العلماء والمؤرخين والفقهاء والادباء من معاصريه في المشرق والمغرب الاسلاميين (١). فلا تظفر أخبار نشأته من كتاب حديث عنه بغير ثلاث صفحات يقفز فيها كاتبها من مناقشة نسبه الى رحلته عن موطنه وهو في العشرين من عمره (٢) ويقتصر كل من ياقوت وابن أبي أصيبعة في معرض كلامهما على نشأته على اشارة قصيرة الى مسقط رأسه. لكن الاشارات القليلة المتوافرة عن نشأته، وما وصل الينا من آثاره، والاشارات الى ما لم يصلنا منها (٣)، تكفي لرسم المعالم الرئيسية لسبل التعليم ومواد الدراسة التي غذت ثقافة البيروني.

وأول ما تجدر الاشارة اليه هنا هو أن البيروني وغيره من علماء النصف الاول من القرن الحادي عشر الميلادي وجدوا في متناولهم آثار قرنين كاملين اضطلع خلالهما العلماء المسلمون بترجمة الاثار العلمية واليونانية، وتناولوها بالشرح والتعليق، وألفوا هم أنفسهم كتبا أضافت الكثير الى العلم اليوناني، وصححت الكثير مما شابها من خطأ، وما اعتورها من نقص. وتكفي نظرة واحدة الى المراجع التي يشير اليها البيروني في القانون المسعودي أو رسائل البيروني لتكوين فكرة عن دينه لانجازات من سبقه من العلماء المسلمين. ففي رسالته " استخراج الاوتار " وحدها يناقش

مقالة في مصيئات الحوالحادثة في العلو :

مقالة في لاسديو الهند عند محيئة الادبي :

مقالة في نقل حواص (صواحي ؟) الشكل القطاع الى ما يغني عنه :

20 ورق (40 صفحه) •

مقالة علم الهيئة ما يحدث في بسيط الكرة : 155 ورق (310 صفحه)•

این کتاب را به نام اصفهبد طبرستان حیلحیلان ابو العباس مرزبان ابن رستم ابن شروین اتمام کرده است و به نام های ' مقالید علم الهیئة " و " مقالید الهیئة " شهرت دارد (رک : کشف الظنون ، ج 2 ، باب المیم ص 312) •

مصنوبات الضرب :

نزهة النفوس و الافکار في حواص المواليد الثلاث المعدن و النبات والاحجار (؟) :

جمعا 160 اثر ـ مکرر و غیر مکرر ـ در این مقاله گرد آمده است• امیدوارم تحقیقات دانشمندان و " نیروی شناسان " روی هر یک از این آثار سر نوشت آنها را به خوشایسته و شایسته روشن سازد •

تحقیق احمد سعید الدمرداش) .

مقالة في استخراج قدر الارض بعد الخط الافقي في قلل الجبال :

60 ورق (120 صفحه) .

مقالة في ان لوازم تجزي المقادير لا الى نهاية قريبة من امر الخطين

اللذين يقربان و لا يلتقيان في الاستبعاد : 10 ورق (20 صفحه) .

مقالة في تبيين راي بطليموس (بطلميوس) في السالخداة : 7 ورق

(14 صفحه) .

مقالة في تحصيل الشعاعات بما بعد الطرق عن الساعات : 10 ورق (20ص)

مقالة في تصحيح الطول و العرض لمساكن المعمور من الارض :

مقالة في تصحيح كلام ابي سهل القوهي (الكوهي) في الكواكب المنقضه :

15 ورق (30 صفحه) .

مقالة في تعبير الميزان لتقدير الازمان : 15 ورق (30 صفحه)

مقالة في تعيين البلد من العرض و الطول كلاهما : 20 ورق (40 صفحه).

مقالة في تقسيط القوى و الذلا لات بين اجزاء البيوت الاثني عشر .

15 ورق (30 صفحه) .

مقالة في حكاية طريق الهند في استخراج العمر :

مقالة في دلالة الآثار العلوية على الاحداث السفلية : 30 ورق (60 ص)

مقالة في سير سهمي السعاده و الغيب :

مقالة في صفة اسباب السخونة الموجودة في العالم و اختلاف فصول السنة :

45 ورق (90 صفحه) .

مقالة في طالع قبة الارض و حالات الثوابت ذوات العرض : 30 ورق (60ص)

این مقاله را برای یکی از محبان خرجان نوشته است .

مقالة في علة علامات البروج في الريحات من حروف الجمل : 15 ورق (30 ص)

مقالة در تلافي عوارض زلزله (ر ک : تلافي عوارض الزله في كتاب كتاب دلايل القبلة) ۰
مقالة صغيره في اعتبار مقدار الليل و النهار في جميع الارض: لتعريف كون السنة يوما تحت القطب بغير التشكيل ۰
مقالة في الاستحار (اشتحار) في قد الاشحار (كذا) ۰
مقالة في البحث عن الطريقة المتعرفة المذكوره في كتاب الآثار العلويه :
40 ورق ۰ (80 صفحه) ۰
مقالة في التحليل و التقطيع للتعديل : 70 ورق (140 صفحه) ۰ اين مقاله به سؤال يك نفر در " حد اول تعديل الشمس " شك كرده و به طريق تحليل بر آن حد اول " راهبري نمي شد — نوشته آمد ۰
مقالة في الكلام على الكواكب ذوات الاذناب و الذوائب : 65 ورق (130 ص
مقالة في النسبة التي بين الفلزات و الجواهر في الحجم : 30 ورق (60 ص)
مقالة في استخراج الاوتار في الدائره بخواص (عواص ؟) الخط المنحني فيها : 80 ورق (160 صفحه) ۰

اين كتاب را در سال 413 هـ / 1022 م يا 418 هـ ق 1027 م تأليف كرده است ۰ موضوع آن بحث در اوتار و دواير و خطهاي منحني است و ترسيمات و اشكال هندسي گوناگون دارد ۰ تقسيمات آن بر اساس عنوانهايي است كه از طرف مولف برگزيده شده و با الفاظ " فصل " و " مقاله " و " قرآن " منقسم شده است ۰ تحت نامهايي همانند :"ادريس استاد حشمر و " ابي سعيد الضرير " ابوعلي الحسن بن الحسن البصري " و " ابوسعيد احمد بن محمد بن عبد الجليل السجزي " بحث هايي در اثبات مسائل هندسي دارد و مطالبي آورده است و بر اقوال آنان نقد نوشته است ۰
چاپ شده اين كتاب 226 صفحه دارد و با اوراقي كه ابوريحان فرموده مطابقت مي كند (چاپ حيدرآباد دكن ، از انتشارات دائرة المعارف عثمانيه ، حروف سربي ، قطع وزيري ، ضمن 3 رساله ديگر از بيروني ۰ 1367 هـ ق / 1938 م ۰ چاپ مصر ، الدار المصريه للتاليف و الترجمة ،

سبت داده است : " كتاب تسطيح الكرة لابراهيم بن حبيب الفزاري المتوفي سنه (؟) و لبطليموس القلودى نقله ثابت الى العربية و فسره ثبس الروس الاسكندرى المهندس و للبيرونى المد كورفى آلاثار الباحثه (كذا) كه بايد " الآثار الباقية " باشد .

كتاب تنقيح التواريخ و امثال ذلك .

كتاب در بيان لوازم دو حركت (رک : لوازم الحركتين) . اين كتاب را به نام سلطان مسعود غزنوى نوشته و گويند همهٔ مطالب آن را از قرآن مجيد اقتباس كرده بود .

كتاب فى تحقيق منازل القمر (رک : تحقيق منازل القمر) : 180 ورق (360 صفحه) .

كلام فى المستقر و المستودع : 10 ورق (20 صفحه) .

كيفية رسوم الهند فى تعلم الحساب .

لوازم الحركتين (رک : كتاب در بيان لوازم دو حركت) .

مختار الاشعار و الآثار : (رک : كشف الظنون ، ج 2 ، باب الميم ، علم مخارج الحروف ، ص 239) .

المداريين المتحديين و المتساويين (و عملت كتاباً —) .

المسامرة فى اخبار خوارزم : (رک : تاريخ نظم و نثر در ايران و در زبان فارسى ، تأليف سعيد نفيسى ، ج ا ، ص 30) .

المسائل المنحية فى المعنى المتعلقة بانكسار الصناعة (؟) 70 ورق (140 صفحه) .

مطرح الشعاع ثابتا على تغير البقاع : 15 ورق (30 صفحه) .

مفتاح علم الهيئة : 30 ورق (60 صفحه) .

ظاهراً اين كتاب را برى قاضى ابوالقاسم العامرى نوشته ومتضمن مبادى مجرده اشكال در علم هيئت است .

کتاب الارقام (؟) ٠

کتاب الاطوال للعرس ٠

کتاب التعلیل با حالة الوهم فی معانی المطم (رک : التعلل با حالة الوهم فی مطم دولی الفهم " ٠

کتاب الدستور (رک : الدستور) : در معجم الادبا به این اثر اشاره رفته است

کتاب الصیدنه (الصیدله ٠) : نسخهٔ خطی این کتاب در کتابخانهٔ بروسه در ترکیه و عکسی آن در اختیار آقای حکیم نیر واسطی در لاهور است ٠

کتابت در سال 678 هـ ق کاتب منصور التبریزی ، 149 ورق (298ص)

در فهرست مخطوطات شفیع تألیف آقای دکتر محمد بشیر حسین ، مطالبی در باره نسخهٔ خطی الصیدنه (الصیدله) آمده است ٠ ابوریحان این کتاب را به عربی تصنیف کرده است ٠ ترجمه در عهد قطب الدین ایبک (در هند) و برای التتمش صورت پذیرفته است ٠ ترجمه از جلال الدین ابوبکر فرزند علی فرزند عثمان اسیعره یی (اسپره یی) کاسانی به نام فرمانروای دهلی شمس الدین معز السلام ابوالفتح المظفر ایلتتمش سلطان 607ـ 233 به فارسی برگرد انیده است ٠ ترجمه یی است آزاد و با متن عربی فرق بسیار دارد ٠

4 نسخه از این ترجمه در کتابخانه ها موجود است : موزهٔ بریتانیا به شماره 5849 ، منیسا کتل به شماره 1789 ، فیلم آن در کتابخانهٔ مرکزی دانشگاه به شماره 966 ، کتابخانهٔ مجلس شورای ملّی به شماره 459 ٠

(رک : فهرست نسخه های خطّی فارسی ، ج ۱ ، نگارش احمد منزوی ، شمارهٔ 14 ، از انتشارات موسّسهٔ فرهنگی منطقه یی (آر سی دی) ، چاپ تهران ، ص 501، و 502 کشف الظنون ، ج 2 باب الکاف ، ص 154) ٠

کتاب العمل فی الاصطرلاب (رک : رساله فی معرفة الاصطرلاب ، رساله در اصطرلاب) ٠

الکتابة فی المکاییل و الموازین و شرایط الطیّار و الشواهین :

کتاب تسطیح الکرة : حاجی خلیفه در کشف الظنون این کتاب را به چند نو

نسخهٔ خطی کتابخانهٔ آصفیه به شمارهٔ 374 (رک : فهرست آصفیه ج 3 ، ص 336 ـ 337) . برای تصحیح و چاپ این کتاب 7 نسخه در اختیار مصححان آن بوده است :

1ـ نسخه بودلین ، آکسفورد ، به شمارهٔ 516 ، و کتابت 475هـ 1082م .

2ـ نسخه پاریس ، کتابخانهٔ ملی ، به شمارهٔ 6840 ، و کتابت 501هـ / 1108م .

3ـ نسخهٔ استانبول ، کتابخانهٔ ملی ، به شمارهٔ 1498 ، و کتابت 531هـ / 1136م .

4ـ نسخهٔ استانبول ، کتابخانهٔ بایزید ، به شمارهٔ 2277 ، و کتابت 536هـ / 1141م .

5ـ نسخهٔ توبنجن (دانشگاه ــ) به شمارهٔ 1613 ، و کتابت 562هـ / 1166م .

6ـ نسخهٔ بریتانیا ، لندن ، به شمارهٔ 1997 ، و کتابت 570هـ / 1174م .

7ـ نسخهٔ مصر دارالکتب المصریة ، قاهره ، به شمارهٔ 866 ، و کتابت 673هـ / 1284م .

باوجود این 7 نسخه ، ادارهٔ دائره المعارف العثمانی حیدرآباد دکن از سال 1373 تا 1375 هـ ق قانون مسعودی را در سه جلد با حروف سربی و قطع وزیری در 1487+ 59 صفحه چاپ و منتشر کرد . مقدمهٔ تحقیقی به قلم سید حسن باراتی ووینتر H. J. Winter با فهارس اعلام و مطالب در پایان هر سوم آمده است ، اما مقدمهٔ انگلیسی در هر جز مکرر آورده شده است .

<u>القرعة المثمنة لاستنباط الضمائر المخمسة شرح مزامیر القرعة المثمنة :</u>

<u>القرعة المصرحة بالعواقب :</u>

<u>کتاب الاطوال و العروض:</u> در کشف الظنون چنین آمده است : " و غالب ما ذکره غیر صحیح و فیه غلط کثیر کما ذکره ابوالریحان فی القانون " . (رک : کشف الظنون ، ج 2 ، باب الکاف ، ص 137) .

علل ریح جعفر مکی بان معشر :

غـرة الزیجات :

غروب الشمس عند مناره اسکندریة : (مقالـة فی ـــ) : 40 ورق . (80 ص)

الفحص عن نوادر ابی جعفر عمر بن الفرخان : 240 ورق (480 صفحه) .

فی امر الممتحن و تصحیر ابن کیسوم المفتش ، اذ کان تعدی طوره و جهل

نفسه فی هذا الباب (یعنی الرج الخوارزمی) : 100 ورق (200 ص)

فیما اخرج ما قوة الاصطرلاب الی الفعل : 30 ورق (60 صفحه) . (رک :

رساله فی الاسطرلاب ، رسالة فی معرفة الاصطرلاب) .

قافیة الالف من الاتمام فی شعر ابی تمام (رک : شرح دیوان ابی تمام) .

القانون المسعودی فی الهیئة و النجوم : (3 جلد) این کتاب را در سال

421 هـ ق به نام مسعود بن محمود بن سبکتکین به اتمام رسانیده است و

لیکن در سال 427 هـ ق که فهرست تألیفات خود را نوشته بنا به گفتهٔ

خود شهـور نا تمام بوده است . موضوع این کتاب هیئت و نجوم و جغرافیا و

تاریخ است . تقسیمات آن به طور کلی بر 3 جزء و جمعاً بر یک مقدمه و 11 مقاله

و 145 باب است . جزء اول مقدمه و 4 مقاله و 41 باب ، جزء دوم 4 مقاله

و 59 باب ، جزء سوم دو مقاله و 25 باب دارد . در هر جزء تقسیمات دیگر

و جد و لهای نجومی و گاه شماری دارد ، از جمله : جدول صوم النصاری .

اعیاد النصاری ، جد اول الجیوب و جد اول دیگر و اشکال هندسی و

امثالهم .

نسخه های خطی این کتاب در کتابخانه های دنیا موجود است .

از جمله :

نسخهٔ خطی کتابخانهٔ ریاست رامپور در 584 صفحه به کتابت 1035

خط خوش نسخ ، جدول و لوح طلایی و دو نسخه نقاشی دندان موشی و

هر صفحه 29 سطر . (رک : فهرست کتب عربی کتب خانهٔ ریاست رامپور .

ج 1 ، ص 428) .

و محققان بوده است . پاول کراوس آموا در سال 1936 م با حروف سربی و قطع رقعی و 51 صفحه در پاریس طبع کرده است . همین رساله مهمترین ماخذ است برای شناختن آثار بیرونی و امام محمدزکریای رازی ، اما باید تحقیقات دقیق و جست و جوهای عمیق روی هر یک از آثار صورت گیرد .

رصد ابی ریحان البیرونی : (کشف الظنون ، ج ۱ ، علم الرصد ، ص439)

زیج الخوارزمی ، علله و وسعت المسائل المعیدهو الجوابات السدیده :
250 ورق (500 صفحه) .

زیج الارکند : و جعلته بالفاظی اذ کانت الترجمه الموجوده منه غیر مفهومة و الفاظ الهند فیها لحالها متروکة .

زیج العلائی : این کتاب را به سه تن دانشمند منسوب ساخته اند در کشف الظنون چنین آمده است : زیج العلائی للشیخ الامام مؤید الدین العرضی و قیل للاستاذ علاء الدین النیسابوری و قیل لابی الریحان " .
(رک : کشف الظنون ، ج ۱ ، باب الزاء ، علم الزیج ، ص 464) .

زیج مسعودی (؟) .

سر السرور (کتاب —) .

سکلت الاعداد (فی —) جا صفحه : 40 ورق (80 صفحه) .

شرح دیوان ابی تمام (رک : قافیه الالف من الاتمام فی شعر ابی تمام) .

الشموس الشافیة (الشافیة) للعیون : در کشف الظنون چنین آمده است :
" الشموس الشافیه للعیون لابی الریحان محمد بن احمد البیرونی " . (رک : کشف الظنون ج ۱ ، باب الشین ، علم الشروط و السجلات ، ص 505)

العجایب الطبیعة و و الغرایب الصناعیة : موضوع این کتاب در بارهٔ جادو و طلسم و عزیمت و نارنجیات است (رک : کشف الظنون ، ج 2 ، باب العین ص 19) .

عشرت (عشرت) لابی الحسن الاهوازی علی ، کتاب فی هذا اللباب (یعنی الزیج الخوارزمی) فاضطررت الی عمل کتاب الوساطیة بینهما فی 600 ورق (1200 صفحه) .

بیح من اریا حهم و لیس بمعلوم عند اصحابنا •

الدستور (رک : کتاب الدستور) : این کتاب را سلمر تول یا قوت حموی در معجم الادبا به نام ابو الفتح مودود بن مسعود (432 ــ 440 هـ ق) نوشت •

راشیکات الهند : 15 ورق (30 صفحه) • اتفاقاً چاپ شده این کتاب هم 30 صفحه دارد و ضمن سه رسائل دیگر چاپ و منتشر شده است • نسخه یی که این چاپ از روی آن صورت گرفته در سال 631 هـ ق در موصل کتابت شده بوده است • موضوع این کتاب ، نسبت بین اعداد متحابه و مولفه است و برای این منظور ، حد اول و ترسیمات گوناگون دارد •

رأی العرب فی مراتب العدد اصوب من رأی الهند فیها : 15 ورق (30 ص)

رساله حقیقت اسطرلاب : (خطی ، شماره 328 ، فهرست آصفیه ، ج 2 ، ص 334 ــ 335) •

رساله در اشکال هندسی (؟) •

رساله فی الاسطرلاب للبیرونی : این رساله فارسی است و به صورت خطی یا عکسی به شماره 2/ 1971 در کتابخانه مرکزی دانشگاه تهران موجود است• (رک : فهرست که نسخه های خطی کتابخانه مرکزی دانشگاه تهران ، ج 15 ، ص 8 و 28 و 168) •

رساله فی معرفة الاصطرلاب : (خطی) ، 26 صفحه ، خط نستعلیق در مجموعه رسائل فی هیئت شماره 68 کتابخانه ریاست رامپور موجود است (رک : فهرست کتب عربی کتابخانه ریاست رامپور ، ج ا ، ص 425 ، فی هیئت) •

رساله للبیرونی فی فهرست کتب الرازی : این فهرست را در سال 327 هـ ق نوشته و کتب امام محمد زکریای رازی (251 ــ 313 ــ یا 323 هـ ق) را در آن آورده است و ضمنا 113 تالیف خود را نیز در آن ذکر کرده است و نیز 12 کتاب و رساله از ابونصر منصور عراق و 12 کتاب و رساله از ابوسهل عیسی بن یحیی و یک رساله از ابو علی حسن بن علی الجیلی که به نام خود انوریحان کرده بوده اند آورده است • این فهرست همواره مورد نظر دانشمند

جلاء الاذهان فی زیج البتانی :

الجماهر فی تحقیق معرفة الجواهر (کتاب —) : این کتاب را به نام
شهاب الدوله ابوالفتح مودود بن مسعود (431 — 440 هـ ق) کرده .
موضوع آن ، شناخت سنگها و احجار پربها و فلزات از لحاظ طبیعی و تجاری
و خواص طبی و فیزیکی و کیمیاوی است . ابوریحان در این کتاب اوزان
مخصوص 18 نوع از سنگهای گران بها و مراکز آنها را نشان داده است .
الف — کرنکوف F.Krenkow این کتاب را تصحیح کرده و به چاپ رسانیده
است . و نیز از طرف دائره المعارف عثمانیه در سال 1355 تا 1357 هـ ق
به قطع وزیری و حروف سربی در 256 + 273 + 320 صفحه چاپ شده
است .

جمع الطرق السائره فی معرفة اوتار الدائرة :

الجوابات عن المسائل الوارده العشر الکشمیریة :

الجوابات عن المسائل الوارده من منجمی الهند : 120 ورق (240 ص)

جوامع الموجود لخواطر الهنود فی حساب التنجیم : 55 ورق (110 ص)

حدیث اورمزد یار و مهر یار :

حدیث دادمه و گرامید حت حیلی الوادی (کذا) :

حدیث صنمی البامیان :

حدیث قسیم السرور و عین الحیاة :

حدیث نیلوفر فی قصة دبیستی و بربهاگر :

خلاصه کتاب التفهیم لاهل التنجیم : نسخهٔ خطی این کتاب در مجموعهٔ
سبع شداد ، فی هیئت ، شمارهٔ 69 در کتابخانهٔ ریاست رامپور موجود است
و 84 صفحه دارد . (رک :
فهرست کتب عربی موجوده کتب خانهٔ ریاست رامپور ، ج 1 (ص 423) .

خیال الکسوفین عند الهند : و هو معنی مشتهر فیما بینهم لاد حلومه

تکمیل حکایات جد الملک الطبیب السنی فی مبدأ العالم و انتهائه : تقریباً 100 ورق (200 صفحه) •

تکمیل زیج جد ربالعلل و تهذیب اعمال من الزلل : 200 ورق (500 ص)

تکمیل صناعة التسطیح :

تلافی عوارض الزلة فی کتاب دلایل القبلة :

تمهید المستقر لتحقیق معنی الممر : 60 ورق (120 صفحه) •

چاپ شده این رساله 108 صفحه دارد و با آنچه 60 ورق (120 صفحه) در اصل بوده تا اندازه ای مطابقت دارد • از روی نسخه یی چاپ شده در سال 631 هـ ق در موصل کتابت شده بوده است • موضوع آن ، بحث درباره دوایر و کرات فلکی و کواکب و اقمار و اعمال آنها ، دارای جد اول و ترسیمات مختلف ، و تقسیمات آن بر اساس عنواناتی که از طرف مصنف بر گزیده شده است • این رساله ضمن 3 رساله دیگر از طرف دائرة المعارف عثمانیه حیدرآباد دکن ، به سال 1367 م به قطع وزیری و حروف سربی در 108 صفحه چاپ و منتشر شده است •

التنبیه علی صناعة التمویه وهی احکام النجوم : (ر ک : کشف الظنون ، ج 1 ، ص 255) •

تنویر المطامح الی تحلیل الارباح :

تهذیب الاقوال فی تصحیح العروض و الاطوال : 200 ورق (400 صفحه) •

تهذیب الطرق المحتاج الیها فی استخراج هیئة الفلک عند الموالید و تحاویل السنین و غیرها من الاوقات : ورق (120 صفحه) •

تهذیب شروط العمل لتصحیح سموت القبل : 40 ورق (80 صفحه)

تهذیب فصول الفرغانی : 200 ورق (400 صفحه) •

این کتاب را برای ابوالحسن مسافر در موضوع " هیئة فصول الفرغانی" نوشته است •

کدام ترجمه و کدام تصنیف است باید تحقیق عمیق صورت گیرد • موضوع این کتاب در هندسه و جبر و حساب و اعداد و هیئت و احکام نجوم و اسطرلاب وتعلیم همه آنها است ومشحون است از اصطلاحات دقیق فارسی هندسه و حساب و ستاره شناسی و اعداد ، و از این کتاب به کتاب های دیگر فارسی نیز راه یافته است •

نسخه های خطّی آن در این جای ها موجود است :

کتابخانهٔ مجلس شورای ملی ایران • کتابت 538 هـ ق ، شماره : 2132 •

موزهٔ بریتانیا ، کتابت 685 هـ ق ، شماره : 7696 •

کتابخانهٔ مدرسهٔ عالی مسجد سپه سالار ، سدهٔ 12 هـ ق ، شماره : 664 •

کتابخانهٔ مرکزی دانشگاه تهران ، کتابت 1267 هـ ق ، شماره : 4722 •

کتابخانهٔ مرکزی دانشگاه تهران ، کتابت 1270 هـ ق ، شماره : 3752/3 •

کتابخانهٔ مجلس شورای ملّی ایران ، تحریری روشن ، کتابت 1293 هـ ق ، شماره : 2131 •

کتابخانهٔ ملّی ملک ، مکتبهٔ نستعلیق ، سدهٔ 13 هـ ق ، شماره: 3254•

(ر ک : فهرست نسخه های خطّی فارسی ، تالیف احمد منزوی ، ج 1 ، و 265 ـ 276 ، چاپ تهران ، از انتشارات مؤسسهٔ فرهنگی منطقه یی " آر ـ سی ـ دی " •

التفهیم لا وائل صناعه التنجیم : این کتاب به زبان عربی است ، امّا به تحقیق معلوم نیست که عربی را اول نگاشته یا فارسی را ؟ (ر ک : التفهیم لا وائل صناعه التنجیم ، فارسی) •

<u>تقاسیم الا قالیم</u> : یاقوت حموی در معجم الادبا از این تصنیف یاد کرده است

<u>تقویم القبله بتصحیح اولها و عرضها</u> : (کتاب فی ـ) : 15 اوراق (30 صفحه) •

تذکره فی المساحة للمساحر المقوی : 10 ورق (20 صفحه) .

ترجمهٔ قصهٔ وامق و عذرا :

ترجمهٔ کتاب الموالید الصغیر لزاهمر (کذا) .

ترجمهٔ کتاب شامل فی الموجودات المحسوسة و المعقولة .

ترجمة کتاب ما محل (؟ پاتنجالی) فی الخلاص من الارتبارک :

ترجمة کلب بارة : و هو مقالة للهند فی الامراض التی تحری العفونة .

ترجمة ماهی براهم سد هاند (؟) من طرق الحساب : 40 ورق (80 ص)

تسطیح الصور و تبطیح الکور : 10 ورق (20 صفحه) .

تسطیح الکرة : (ر ک : کتاب التسطیح الکرة) .

تسهیل التصحیح الاصطرلابی و العمل بمرکباته من الشمالی و الجنوبی (کتاب فی ــــ) : 10 ورق (20 صفحه) .

تصحیح المنقول من العرض و الطول : 40 ورق (80 صفحه) .

تصور امر الفجر و الشفق فی جهة الشرق و الغرب من الافق :

التطبیق الی تحقیق حرکة الشمس :

التعلل با حالة الوهم فی بطن اولی الفهم (کتاب ـــ) .

التفهیم لا وائل صناعة التنجیم : این کتاب به زبان فارسی است و آنرا به سال 420 هـ ق به نام ریحانه بنت الحسین یا بنت الحسن تصنیف کرده است و در کشف الظنون آمده که در سال 421 آنرا به نام ابی الحسن علی بن ابی الفضل الحاشی کرده است . این کتاب با مقدمه و تصحیح و حواشی و تعلیقات استاد جلال الدین همایی از سال 1313 تا 1317 هجری شمسی در تهران چاپ شده است و در سال 1934 م توسط رامسی به انگلیسی ترجمه و با مقدمهٔ تحقیقی در لندن انتشار یافته است . ابوریحان بیرونی این نسخه را به عربی نیز تصنیف یا از فارسی ترجمه کرده است اما شناختن اینکه

تحدید نهایات الاماکن لتصحیح مسافات المساکن :

100 ورق (200 صفحه) ۰ در مقدمهٔ انگلیسی قانون مسعودی سخنی تحت عنوان ۰ " التحدید " که در سال 416 هـ ق / 1025م تصنیف شده و در استانبول موجود است آمده است ۰

التحدید من قبل الترک :

تحصیل الآن من الزمان عند الهند : 100 ورق (200 صفحه) ۰

تحصیل الراحة بتصحیح المساحة :

تحقیق ما للهند من مقالة مقبولة فی العقل او مرذولة : (رک : تاریخ الهند تاریخ ابوریحان)۰

700 ورق (1400 صفحه) ۰ این کتاب را به نام عبدالمنعم ابن علی ابن نوح تفلیسی کرده و به سال 423 هـ ق آنرا به انجام رسانیده است چاپ لیپزیک ، 1925م ، سرنی ، وزیری ، 365 + 41 صفحه ۰ چاپ حیدرآباد دکن ، دائرة المعارف عثمانیه ، 1377 هـ ق / 1958 م ۰ 68 + 544 + 30 + 44 ص ۰

ترجمهٔ انگلیسی آن در دو جلد (ج 1 ، 38+ 544 ، ج 2 ، 606 ص) از ساخائو ، چاپ دوم ، لاهور ، 1962م ۰ این کتاب یک مقدمه و 80 باب دارد و حاوی مسائل مختلف عقیدتی و فلسفه و دینی و فکری و تاریخی و اجتماعی و جغرافیای و اعیاد دینی و ملی و آداب و رسوم و ستاره شناسی و ریاضی و هیئت و حساب است ، و بسیاری از اسامی و اصطلاحات علمی سنسکریت را در این کتاب می توان یافت که اکثر آنها را به صورت حد اول گولد گون ترتیب و تنظیم داده است در چاپ لایپزیک همهٔ اصطلاحات و کلمات سنسکریت فهرست شده ، در چاپ حیدرآباد دکن ، فهارس اماکن و اشخاص و مطالب آمده است ۰

تحقیق منازل القمر : 180 ورق (رک : تراث الاسلامیه ، ج 2 ، ص 129)

تذکرة فی الحساب و العد بارقام السند و الهند : 30 ورق (60 صفحه)

تذکره فی الارشاد الی صوم النصاری و الاعیاد : 20 ورق (40 صفحه)۰

موضوع آن بحث درباره روشنایی ها و تاریکیها و تیرگی ها و سیاهی ها و افق ها و اختلاف اوضاع و ارتفاعات روی زمین و کواکب و اقمار است ، و بر یازده قسمت و چندین باب منقسم است و گاهی از اشعار عربی استفاده می کند و به اقوال مختلف ریاضی دانان و فلاسفه و ائمه اطهار و خلفای راشدین استناد می جوید ، مانند : " جعفر بن محمد الصادق (ع) " ،
" عمر بن الخطاب (رض) " ، " ابو موسی الاشعری (رح) " ،
" الکندی " و " ابوالوفا " و امثالهم . (چاپ حیدرآباد دکن ، از انتشارات دائرة المعارف عثمانیه ، 1368 هـ ق ، سربی ، وزیری ،
126 صفحه . ضمن چهار رسالۀ بیرونی) .

الاسعات لتصحیح القبلة (کتاب فی ــ) : 45 ورق (90 صفحه) .

ایضاح الادلة علی کیفیة سمت القبلة : 25 ورق (50 صفحه) .

البرهان المبین فی اعمال التسییر :

تاریخ الامم المشرقیة :

تاریخ ابوالریحان (رک : تحقیق ماللهند ، تاریخ الهند) .

تاریخ خوارزم : (رک : المسامرة فی اخبار خوارزم) : شامل اخبار و آثار و قصص و حکایات و وقایع تاریخی درباره خوارزم که شنیده و دیده است . این کتاب ظاهراً از میان رفته و در تاریخ بیهقی از آن یاد شده (رک : لغت نامه ، آ ـ ابوسعد ، ص 467 ، تاریخ نظم در ایران و در زبان فارسی ، تالیف سعید نفیسی ، ص 30) .

تاریخ الهند (رک : تحقیق ماللهند ، تاریخ ابوالریحان) . ادوارد ساخائو این کتاب را به انگلیسی در دو جلد ترجمه کرده و در سال 1887 جلد اول ، و در 1910 م جلد دوم را در لندن انتشار داده است .

تجرید الشعاعات والانوار عن الفضایح المدونة فی الاسفار :

55 ورق (110 صفحه) . حاجی خلیفه در کشف الظنون گوید : این کتاب را برای شمس المعالی قابوس بن وشمگیر (362 ـ 402) نوشته است .

تحدید المعمورة و تصحیحها فی الصورة

احتلاف دوی الفصل فی استحراج العرض و المیل : (مقاله ی —) .
الارشاد الی تصحیح المادی اشتمل علی المودارات : (مقاله ی —).
الارشاد الی مایدرک ولاینال من الابعاد .
الارشاد فی احکام النحوم :
(کشف الظنون ، ج ۱ ، باب الالف ، علم الارتماطیقی ، 69)
استحراج الکعاب و اصلاع ماورا من مراتب الحساب : 100 ورق (200 ص)
الاستشهاد با حتلاف الارصاد .
استعمال الاصطراب الکری ، : 10 ورق (20 صحه) .
استعمال دوائر السموت لاستحراج مراکر البیوت : 100 ورق (200 صحه
این کتاب را ظاهرا برای ابی الحسن مسافر نوشته است در آن
هنگام که در بارهٔ " تسویه البیوت " ، بحث کرده است .
استیعاب الوجوه الممکنه فی صنعة الاصطرلاب . 80 ورق . (160 صحه)
این کتاب ظاهراً پیش از سال 390 هـ ق و پیش از آثار الباقیه
تالیف شده است زیر آثار الباقیه در سال 391 تالیف شده و در سال 327
در سن 65 سالگی ابوریحان ، هنوز باتمام بوده است . ابوریحان در این
کتاب هر گونه روشی را که در صنعت اصطرلاب (اسطرلاب) معمول بوده و
بهترین صورت نقل و شرح کرده است . (کشف الظنون ، ج ۱ ، علم
تسطیح الکره ، 217) .
استیعاب فی تسطیح الکره .
(رک : کشف الظنون ، ج ۱ ، باب الالف ، ص 74) .
الاعتدار عما سبق لی فی تاریخ الاسکندر : 10 ورق (20 صحه) .
افراد المقال فی امر الاظلال : 200 ورق . (400 صحه)
این کتاب را برای ابی الحسن مسافر که در این فن صاحب نظر بوده
نوشته است . چاپ شده این رساله 126 صحه دارد و با آنچه که در فهرست
آثار بیرونی 200 ورق (400 صحه) آمده مطابقت ندارد ، و از روی
نسخه یی چاپ شده که در سال 631 هـ ق در موصل کتابت شده بوده است.

و بعد از این سال پایان یافته است • این کتاب را به نام شمس‌المعالی قابوس بن وشمگیر زیاری (366 ـ 402) کرده است • در این کتاب از اعیاد ایرانیان و اعراب و مسیحیان و یهودیان و زرتشتیان و صابیان سخن رفته است • و آن را می توان تاریخ علوم اجتماعی و انسانی و دینی گفت •

چاپ اول لایپزیک 1878 م ، چاپ دوم (ایضاً) 1923 م ، عربی وزیری ، با مقدمه آلمانی به قلم ساخائو (ادوارد) 362 + 73 صفحه

چاپ بغداد ، از روی چاپ لایپزیک ، چاپ مصر (ایضا ؟) •

ترجمهٔ انگلیسی 1879 م (لندن) •

نسخه خطی آن ، فهرست دارالکتب الظاهریه ، تألیف ابراهیم خوری ، علم الهیئـــة و ملحقاته ، (1389 هـ ق) ، کشف الظنون ، ج ۱ ، باب الالف ، علم الآثار ، ص 40 •

<u>ابطال البهتان بایراد البرهان علی اعمال الخوارزمی فی زیجه</u>: 360 ورق (720 صفحه) •

ابو طلحهٔ طبیب ـــــ در این باره نوشته و ابوریحان در این کتاب آنرا رد کرده است •

<u>ابطال ظنون فاسدة خطرت علی قلوب بعض الاطبا فی امر الکواکب الحادثه فی الجو</u>: 70 ورق (140 صفه) •

<u>اجوبة الشیخ الرئیس عن مسائل ابی الریحان البیرونی</u>:

ضمن جامع البدایع در سال 1335 هـ ق در مصر چاپ شده ، عربی ، رقعی ، 28 صفحه •

<u>اخبار المبیضه و القرامطه</u>:

<u>اختیار کتاب بطلمیوس</u> •

<u>اختلاف الاقاویل لاستخراج التحاویل</u>: 30 ورق (60 صفحه) •

این کتاب در پاسخ یکی از منجمان ، که دربارهٔ " تحویلات " از ابوریحان سؤال کرده است می باشد •

الاختلاف الواقع فی تقاسیم الاقالیم (مقاله فی ـــ) : 20 ورق (40 صفحه)

مردم و سرگذشت های آنان) ۰
10ــ زیج (شناخت زیج ها و رصد ها و راسمایی و عمل بدان ها)
11ــ علم کواکب دوات الادناب (شناخت ستارگان دنباله دار و هوا شناسی و تحقیق مدارات و منازل ماه و دیگر مسائل) ۰
12ــ کیمیا (شیمی) (میزیک و کانی شناسی و شناخت سنگها و احجار و تعیین ارزش علمی و مادی آنها و نشان دادن اوزان مخصوص از هر یک)۰

تعداد آثار

همانگونه که گفته آمد ، آثار ابوریحان را از 150 تا 180 اثر نوشته اند اما به آسانی این تعداد را نمی توان قبول کرد مگر اینکه تحقیقات دقیق و عمیق صورت گیرد زیرا چند اثر به نامهای گوناگون شهرت یافته اند و حال آنکه در اصل یکی هستند ، چند اثر به مولف یا مصنف دیگر نسبت داده شده ، یک اثر به چند مولف از جمله به ابوریحان منسوب گشته ، چند اثر نا شناخته و چند اثر گم شده و خلاصه نوعی آشفتگی و سردرگمی در شناخت آثار ابوریحان موجود است ۰

تعداد آثار موجود و مفقود :

متاسفانه بسیار دشوار است تا بگوییم که روی هم رفته چند اثر از ابوریحان موجود و چند اثر مفقود است ۰ البته آنهایی که چاپ و نشر یافته بر هیچ کس نا شناخته نیست ، سخن بر سر آن آثاری است که به صورت خطی موجود و یا مفقود و یا اصلاً نابود شده و به ما نرسیده است ۰

فهرست آثار :

اینک فهرست الفبایی اسامی آثار ابوریحان را در ذیل می آوریم و هر گونه آگاهی که درباره آن اثر به دست آمده یعنی نام و تاریخ تصنیف اگر خطی آن موجود است و یا مفقود ، نام کتابخانه و محل آن ، چاپ شده و یا بصورت طبع نرسیده ، جای چاپ ، سال چاپ و نام مصحح و محقق و دیگر مطالب را زیر آن اثر به قدر امکان نقل می کنیم ۰

الآثار الباقیه عن القرون الخالیه :

در سال 391 هـ ق آغاز شده و تا سال 427 هجری نا تمام بوده

ابو ریحان فرض کرده و جمعا آثار ابوریحان را به 180 تصنیف تخمین زده است .

زبان آثار

ابوریحان بیرونی آثار خود را به زبان عربی و فارسی نوشته است اما به زبان خوارزمی و سنسکریت نیز مسلط بوده و احتمالا یونانی و سریانی هم می دانسته است . بدین جهت تعدادی از آثار ابوریحان به صورت " ترجمه " است و گویند از سنسکریت به عربی و از عربی به سنسکریت ترجمه های متنوع فرموده است و می توان ابوریحان را یک " مترجم عالم " نیز به شمار آورد . آثار موجود او به زبان عربی و فارسی است . از آثار فارسی او ظاهرا دو اثر باقی مانده یکی " التفهیم للاوائل صناعة التنجیم " است که گفته می شود توسط خود شاز فارسی به عربی در آمده است دیگری رساله ای در اسطرلاب است . ولیکن برآیین قول شک می توان کرد . مابقی آثار به زبان عربی است .

موضوع آثار

به طور کلی می توان آثار ابوریحان را به 12 موضوع تقسیم کرد :

1_ جغرافیه (شهرها و کشورها و کوه ها و فواصل دریاها وراه ها)
2_ تاریخ (سرگذشت مردمان و جنگها و شاهنشاهان) .
3_ ریاضیات و حساب (کیفیت و کمیت در اعداد و رسوم حساب و روش تعلیم و تدریس آن ها) .
4_ اسطرلاب (اصطرلاب) یا علم آلالات و عمل کردن با آنها .
5_ شعاعات و مدارها (ممرها) شناخت شعاعات و ساعات و ممرها .
6_ اوقات (تقویم و گاه شماری و وقت شناسی) یا شناخت وقت از لحاظ کردن زمان در نزد ملل .
7_ عقاید (آداب و رسوم مردمان و حکونگی جشن ها و مذاهب و عمل بدانها) .
8_ احکام نجوم (ستاره شناسی و احکام ستارگان و ترسیم اشکال هندسی و ریاضی و حساب آنها) .
9_ ادب و داستان (قصه های حقیقی و اساطیری و معمول در میان

300 ورق (600 صفحه) تا فرض می کنیم و جمعا 45000 ورق (90000 صفحه) نوشته است و اگر یادداشت ها و مکتوبات و اشعار او را جز به حساب آوریم شاید حدود 000 ، 100 صفحه در مدت عمرخود نوشته باشد که هر سال 1283 صفحه و در هر روز تقریبا 31 ورق نوشته است . و اگر سالهای کودکی او را ده سال به حساب آوریم به همان تعداد اوراقی را که در هر سال و هر روز نوشته بوده به مراتب بیشتر است .

و از این لحاظ می توان ابوریحان بیرونی را از پرکارترین علمای عصر خود دانست و در این باره گفته اند : " امام وقت خود بود " اما با جست وجوی که در آثار ابوریحان به عمل آمد بعضی از رسایل و مقالات وی ، در داخل آثار به صورت " فصل " و " باب " و " مقاله " و دیگر عناوین آمده است . که اگر روی این مساله تحقیق بیشتر گردد ، شاید تعدادی از آثار او شناخته شود .

متاسفانه آثار ابوریحان بیرونی از گزند اهرمن حوادث و سوانح مصون نمانده است و به طور قطع در جنگهای مختلفی که در مدت یک هزار سال پس از درگذشت ابوریحان در ممالک اسلامی به وقوع پیوسته ، تعدادی کثیر از آن آثار را از میان برده است و احتمال می رود همانگونه که سلطان محمود غزنوی در سال 420 هـ ق کتابخانه بزرگ ری را آتش زد و همه کتاب های کلام و معتزلی و فلسفه و نجوم را بسوزانید و از بقیه هم یکصد شتر بار به غزنین برد ، همانطور نیز شاید غیاث الدین محمد و شهاب الدین غوری نیز در حدود سال 550 تا 556 هـ ق کتابخانه سلطنتی محمود و مسعودی بوده نابود شده است .

ابوریحان به جهت مقام علمی که داشته پیوسته مورد احترام استادان و دانشمندان و شاگردان عهد خود بوده است تا آنجا که چند تن از آن دانشمندان که گفته اند استادان ابوریحان هم بوده اند ، آثار خود را بنام وی کرده اند ، از جمله :

ابونصر منصور عراق 12 کتاب و رساله .
ابوسهل عیسی بن یحیی 12 کتاب و رساله .
ابوعلی حسن بن علی الجیلی یک رساله .

در دایره المعارف اسلامی ، این کتاب ها و رسایل را نیز جزو آثار

گرفتن علم زندگانی می کرد ، علم را برای مال نمی خواست ، علم را برای
به دست آوردن مقام و منصب نمی خواست ، علم را فقط برای علم یاد می گرفت ،
برای علم می اندیشید ، برای علم می نوشت ، برای علم زنده بود ، چنین
است ، او را یکی از اعجوبه های علوم ریاضی ، نجوم ، هیئت ، هندسه
و تاریخ شمرده اند و در این گفته همگان از عصر او تاکنون متفق القولند ·
بنابراین ، چنین دانشمندی متبحر ، همانگونه که خود گفته است و
دیگران نوشته اند می تواند صاحب مصنفات بسیار باشد ، چنان که به
روایات مختلف در کتب تذکره و تواریخ و فهارس ذکر شده است :

1ـ مصنفات او بار اشتری بود ·

2ـ مصنفات او بر شصت ورق (120 صفحه) فهرست شده بود ·

3ـ مصنفات او تقریبا به 150 تصنیف می رسید ·

فهرست 113 تصنیف خود را ابوریحان ضمن فهرست کتابهای امام محمد
زکریای رازی (251 هـ ق / 865 م ـ 313 هـ ق / 925 م و به قولی
935/323 هـ ق) در سال 427 هـ ق آورده است و لیکن در آن موقع
65 سال قمری و 64 سال شمسی داشته است یعنی هنوز هم می توانسته
بنویسد و تصنیف کند و در این سن 10 تا از تصنیفات نا تمام بوده است ،
مانند : القانون المسعودی والآثار الباقیه عن القرون الخالیه · اما در این
آثار نا تمام ، قانون مسعودی را مطابق فرموده خود ش در سال 421 به نام
سلطان مسعود بن محمود بن سبکتگین به اتمام رسانیده است ، و آثارالباقیة
را در سال 391 به نام شمس المعالی قابوس بن وشمگیر زیاری (366 ـ
403 هـ ق) تصنیف کرده بوده است و تا این سال یعنی 427 هـ ق که
به سن 65 سالگی رسیده است هنوز ناتمام بوده است و از هشت کتاب ناتمام
دیگر نیز اطلاعات دقیق و تحقیقی در دست نیست و اگر پس از سال 427
باز هم آثاری تصنیف کرده است ، جسته گریخته در لابلای کتب تواریخ و
سیر ذکر آنها آمده است و چون در سال 440 هـ ق در گذشته و در سال
427 هـ ق 65 سال هجری قمری و 63 سال هجری شمسی داشته است پس
78 سال هجری قمری و 76 سال هجری شمسی عمر کرده است · همانگونه
که گفته آمد در حدود 150 اثر داشته و هر اثر از 7 ورق (14 صفحه)
تا 700 ورق (1400 صفحه) بوده است و حد متوسط هر اثر را

نظری به آثار ابوریحان بیرونی

محمدحسین تسبیحی ـ ایران

گویند : " ابوریحان بیرونی ، دستش از نوشتن و چشمش از دیدن و مغزش از اندیشیدن باز نمی ایستاد مگر در جشن نوروز و مهرگان و یا برای تهیه احتیاجات معاش ! "

و نیز گویند : هنگامی که کتاب قانون مسعودی را تصنیف کرد و آنرا به سلطان مسعود بن محمد غزنوی (1030 ـ 1040 هـ ق) گردانید ، آن پادشاه ، سه شتربار نقره برای وی انعام فرستاد ، اما ابوریحان آنها را نپذیرفت و به خزانه باز گردانید و اینگونه پاسخ داد : " من علم را برای علم خدمت می کنم نه برای مال ! " .

و نیز فقیه ابوالحسن علی بن عیسی الولوالجی گوید : " آنگاه که نفس در سینه ابوریحان به شماره افتاده بود بر بالین وی حاضر آمدم ، در آن حال از من پرسید : حساب جدات فاسده (یکی از مسائل فرائض اهل سنت و جماعت) که وقتی مرا گفتی باز گوی که چگونه بود ؟ "

گفتم : اکنون چه جای این سؤال است ؟

گفت : ای مرد کدام یک از این دو امر بهتر ؟ این مسأله بدانم و بمیرم یا نادانسته و جاهل درگذرم . " .

و من آن مسأله باز گفتم و فرا گرفت و از نزد وی باز گشتم و هنوز قسمتی از راه پیموده بودم که شیون از خانه او برخاست ! "

و همچنین گویند : " شمس المعالی قابوس بن وشمگیر زیاری خواست تا تمامت امور مملکت وی محول کند و فرمان وی در هر کار مطاع باشد اما وی سر باز زد " .

از این جملات چنین دریافته می شود که ابوریحان بیرونی برای یاد

یکم ، نام اثر در هر دو تحریر بعربی است - این علامت تقدم داشتن نسخه عربی است بر نسخه فارسی - اگر نسخه فارسی تقدم داشت ، نام اثر حتماً بفارسی می بود -

دوم سیاق عبارات کتاب تفهیم فارسی در خیلی مواضع بکلی به ترجمه از عربی مانندگی دارد -

این دو مدرک دلیل دیگری است بر تقدم داشتن نسخه عربی کتاب التفهیم بر نسخه فارسی آن -

المراجع

(1) چهار مقاله ، تالیف نظامی عروضی سمرقندی ، حواشی قزوینی ، چاپ تهران ، ص 197

(2) کتاب التفهیم لاوایل صناعة التنجیم تالیف ابوریحان محمد بیرونی با تصحیح مقدمه و حواشی جلال همائی ، تهران 1318 شمسی ص " کز " ـــ " لو "

(3) آ - کاراچکاویسکی مجموعهٔ آثار جلد چهارم باب نهم نشر روسی مسکوا 1957

(4) التفهیم لاوایل صناعة التنجیم تالیف ابوریحان بیرونی دو شنبه 1973

(5) بولگا کاف حیات و آثار بیرونی نشر روسی ص 150 - 149 تاشکند 1973

گردیده میتوانند یا به ترجمان عادی - اتفاقاً ترجمان زبردستی این کار را انجام میداد حتماً اسم خود و تاریخ ترجمه را ذکر می نمود - با گفته نماند که یکی از علل آنکه بیرونی در مقدمه کتاب الصیدنه از زبان فارسی سخن رانده و آنرا قابل تالیفات علمی نمیداند ، با احتمال قوی آن همه سختی و دشوار هائی است که وی در کار کار کرده معین نمودن اصلاحات علمی فارسی بآن روبرو شده است -

4- در هیچ یک از نسخه های محفوظ مانده کتاب التفهیم فارسی نام مترجم دچار نمی شود - در دو نسخه قدیم ترین این تحریر که یکی در کتب خانه تاشکند و دیگری در دو شنبه محفوظ است و بدوران زندگی ابوریحان از جهت قدمت کتابت خیلی نزدیک اند ، نیز از مترجم ذکری نمی رود ، این خود دلیل دیگری است بآن که هر دو تحریر یعنی هم نسخه فارسی و هم عربی بقلم یک نفر یعنی خود ابوریحان تعلق دارد -

حالا می آئیم بمسئله تقدیم یکی از تحریر های دیگری - بفکر اینجانب نسخهٔ عربی کتاب التفهیم ابوریحان تقدم دارد بر نسخه فارسی آن دلائلی که راجع باین طرف مسئله در دست داریم از این قرار است :

1- بیرونی تمام تالیفات خود را تا زمان تالیف کتاب التفهیم چه نوعیکه معلوم است بزبان عربی نوشته و با این زبان در تالیف آثار علمی عادت کرده بود - گر چندی مقصد او برای دختر پارسی زبانی تالیف کردن اثر بزبان فارسی بود ولی از طرف او بر خیلاف تجربه و عادات خود که در تالیف داشت ، یکی یکبار کتاب التفهیم را آنهم در پنج قسمت از ساحه‌های علوم بپارسی تالیف کردن او از نظر دور مینمائد. عادات امروزه ایکی هر یک از ما در تالیف داریم یعنی گر چندی یکچند زبان را میدانیم ولی به یک زبان ، بزبان عادت کردهٔ خود تالیفات علمی را اساساً انجام میدهیم این فکر را تقویت میدهد -

از این جهت عقیده بنده ، این است که ابوریحان پیش از تحریر فارسی کتاب التفهیم ، تحریر عربی را انجام داده ، یا حد اقل استحوان بندی اثررا حتماً بزبان در تالیف عادت کرده و تجربه حاصل نمودهٔ خود یعنی بزبان عربی ترتیب داده است -

دو مدرک زیر این فکر مارا تقویت میدهد :

است ـ این گروه در تالیفات خود به دلیل آورده اند و عمده ترین آنها یکی این است که نام فارسی التفهیم در فهرست کتب او نیامده و ثانیاً ابوریحان نسبت بزبان فارسی خوش بین نبوده است ـ نا گفته نماند که این گروه از دانشمندان بزبان فارسی بلد نبوده و در تحقیقات خود پیش از آنکه باین خلاصه آیند هر دو تحریر را از جهت اسلوب و امثال آن نسنجیده اند ـ از جمله طرفداران این گروه یکی د اکتر بولگاکاف میباشد که کتاب او زیر عنوان " حیات و آثار البیرونی " در این اواخر در تاشکند نشر گردید (5) ـ این مولف عقیده نظام الدین حیدرآبادی ، جلال همائی و بعضی از دانشمندان ایران را در اینکه نسخه فارسی نیز بقلم ابوریحان تعلق دارد قبول ندارد ، دلایل او در این باره همان است که قبلاً ذکر گردید ـ

حالا در این مسئله که تحریر فارسی کتاب التفهیم نیز بقلم ابوریحان بیرونی تعلق دارد دست دادیم که درستی این مسئله را کاملاً تصدیق می نماید از جمله :

1ـ در چند مورد که در کتاب التفهیم تصریح بتاریخ تالیف یعنی 420 قمری مطابق 391 یزدگردی و 1341 اسکندری شده در هر دو تحریر ـــــ هم فارسی و هم عربی یکی است بدون هیچگونه تفاوتی ، این بیان دلالت میکند که حتی دو نسخه بقلم یک شخص تعلق دارد ـ زیرا اگر ترجمان شخص دیگری می بود تاریخ ترجمه را حتماً ذکر می نمود ـ

2ـ در هر دو تحریر یعنی هم فارسی و هم عربی تمام نکات و دقایق ادبی هر دو زبان چنانچه آقای همائی با دقت سنجیده است رعایت شده و گاه بطوری از یک زبان بزبان دیگر برگشته که یکی بهترین راهنمائی دیگری است این البته کار شخصی است که مهارت او در تالیف حد اقل از مولف کمتر نیست این شخص البته خود ابوریحان است نه شخص دیگر ـ زیرا این کار را تنها خود مولف انجام داده میتواند نه مترجم غیر ـ

3ـ اصطلاحات علمی نسخه فارسی نسبت به تمام آن قسمت های علوم که کتاب التفهیم در بر میگیرد بطرز دقیق و معین کار کرده شده است معین نمودن اصطلاحات علمی در زبانی که هنوز در علوم رائج نیست کار بسیار سنگینی است که آن را تنها خود مولف که از تمام علوم وقت بخوبی باخبر است عهده دار

نسخهٔ فارسی التفهیم بر خلاف فکر قزوینی می نویسد که " نگارنده از این نکته غافل نیست که اسلوب نثر نویسی سده پنجم هجری از جهتی بی شباهت بترجمهٔ عربی نیست امّا در مورد کتاب التفهیم شکی ندارد که یکی اصل و دیگری ترجمه است " - پس او بعد از ذکر دلایل متعدد فکر خود را ادامه میدهد : نگارنده باوجود اینکه چند بار نسخ فارسی و عربی را با یکدگر از اول تا آخر مقابله و وارسی کرده ، تاکنون نتوانسته است تعیین کند که فارسی مقدم است یا عربی " (2)

دانشمندانی که در کنگره جهانی ابوریحان بیرونی در ایران راجع باین مسئله در خطابه ها و تالیفات خود توقف کرده اند از حدود فکر قبلاً " ذکر شد - آقای همائی خارج نگردیده ، اساساً عقیده او را پیروی کرده اند

گروه سوم از دانشمندان در مسئله بقلم ابوریحان تعلق داشتن تحریر فارسی التفهیم شبه کرده اند - از جمله خاور شناس مشهور شوروی اکادمیسین کاراچکاویسکی J.U.KRACHICAVSKI در تالیف خود مسمی به "ادبیات جغرافی عرب در عصر یازدهم میلادی " این نسخه را که ابوریحان بیرونی نسبت بزبان فارسی در مقدمه " کتب الصیدنه " ذکر نموده است ، عیناً بروسی نقل نموده میگوید که بیرونی که نسبت بزبان فارسی اینگونه بدبین بوده است جای شبهه است که او بر خلاف گفتهٔ خود التفهیم را بزبان فارسی نیز تالیف کرده باشد " (3)

گروه چهارم از دانشمندان بر این عقیده اند که استاد ابوریحان کتاب التفهیم (4) برای ریحانه بنت الحسن خوارزمی تالیف نمود بطوری که نوآموزان صناعه تنجیم را بکار آید - زبان دختر فارسی بود و هم نوآموز فارسی زبانی زبان خود را بهتر میدانند - بنابر آن ابوریحان کتاب را نخست بزبان فارسی تالیف کرده و چون در آن زمان کتب ادبی نزد فضلا و علما متداول تر نبوده آنرا به زبان عربی نیز نقل نموده است - از جمله مولفان آخرین که این عقیده را پیروی می کنند یکی صاحب نو نسخه کتاب التفهیم بتاجکستان پروفسور محمد عاصمی است -

گروه پنجم از دانشمندان در مسئله بقلم ابوریحان تعلق داشتن نسخهٔ فارسی بکلی مقابل میباشند و میگویند که ابوریحان اثر خود را بعربی تالیف نموده پس در ادوار بعده شخص نا معلومی آنرا بفارسی ترجمه کرده

راجع به تحریر اوّلین التفهیم

پروفسور عبدالغنی میرزایف ـ تاجکستان

جناب رئیس، بانوان و همکاران ارجمند ـ خطابه بنده راجع بتالیف اولین کتاب " التفهیم لاوائل صناعة التنجیم " تالیف ابوریحان بیرونی قدری طولانی است ولی برای اینکه اهل کنگره را خسته نکرده باشم، خلاصه خطابه ام را در مدت یکچند دقیقه باطلاع شما خواهم رسانید ـ

راجع به تحریر اولین التفهیم تا سال 1973 یعنی تا کنگره های جهانی بیرونی در بین اصحاب تحقیق عقاید گوناگون در جریان بود ـ این عقیده هائی مختلف راجع بموضوع مزبور در کنگره هائی جهانی ابوریحان بیرونی که قبلاً در افغانستان، اتحاد جماهیر شوروی و ایران گذشت، نه اینکه حل شد بلکه بیشتر وسعت پیدا نمود ـ در این کنگره جهانی ابوریحان که 15 روز است در پاکستان ادامه دارد، نیز این مسئله بطور مورد بحث قرار گرفته می آید ـ

عقیده های درباره تحریر نخستین کتاب التفهیم ابوریحان بیرونی بیان کرده اصحاب تحقیق را اگر جمعیت نمائیم آنها را ممکن است به پنج گروه تقسیم کرد :

گروهی از دانشمندان بر این عقیده اند که تحریر فارسی و عربی کتاب التفهیم دو تالیف مستقل میباشد از جمله مرحوم قزوینی در حواشی " چهار مقاله " نوشته اند که " کتاب التفهیم " را بیرونی برای ریحانه بنت الحسن خوارزمیه تالیف نموده است و ابوریحان خود این کتاب را به هر دو زبان نوشته، بدون اینکه یکی از آنها ترجمه دیگری باشد " (1)

گروه دوم از دانشمندان باین عقیده اند که تحریر عربی و فارسی التفهیم هر دو بدون تردید بقلم خود ابوریحان بیرونی تعلق دارد ـ امّا اتفاقاً یکی ترجمهٔ دیگری است ـ از جمله آقای جلال همائی در مقدمه نشر

اولیه " بسم اللّٰہ الرحمان الرحیم قال ابوریحان محمد بن احمد البیرونی فی تحدید نہایات الاماکن لتصحیح مسافات المساکن " لما کانت العقول محتاجۃ الی الا ستعداد و النفوس غیر مستغنیۃ من ••••••• "
و آخرہ " و اللّٰہ تعالی یعین علی ما انا فیہ من تصحیح الحرکات السماویۃ •••• " تم تحدید الاماکن لتصحیح مسافات الا ماکن و فرغت منہ لسبع یقین من رجب سنۃ ست عشر (عشرۃ) و اربع مائۃ ۔"
فاذا قبلنا الادعاء الذی یقول ان ہذہ النسخۃ بخط البیرونی نفسہ فان تاریخ التالیف المذکور یکون فی الوقت نفسہ تاریخ النسخ و سواء کانت النسخۃ بخط البیرونی او بخط خطاط آخر قد حافظ علی عبارۃ المولف و نقلہا بنصہا بذلک العصر و کتاب تحدید الاماکن تحتوی علی ابحاث قیمۃ فی الریاضیات و الجغرافیا و آراء فی اصول البحث ___________ قام بہ البیرونی من ارصاد و ابحاث ممہدۃ فی مختلف العلوم ۔
و ہکذا ترون الحیز الواسع الذی تشغلہ مولفات البیرونی فی مکتبۃ واحدۃ من مکتبات استانبول و ہو محسوس علی مقدار محبۃ و تقدیر الا تراک للبیرونی ۔

ابى سعيد مسعود بن يمين الدولة و امين الملة محمود اطال الله بقائه "۔
اولـه : بسم الله الرحمان الرحيم المسعود من سعد بالله و تفرد بتأيده اياه من الاشكال و الاشباه فلا واضع لمن رفع ولا واحد لمن منع ۔
وآخره الدعاء للملك الاجل السيد المعظم ظهير خليفة الله و ناصرد ين الله و حافظ عباد الله المنتقم من اعداء الله ابى سعيد مسعود بن يمين الدولة و امين الملة محمود اطال الله بقائه ۔
و قد كتبت هذه النسخة سنة 531 من الهجرة و قد قرأها عدة من العلماء و الفلكيين فى ازمنة مختلفة و بعضهم كان قريب من عصر المولف ۔
و يعتبر " القانون المسعودى " اكبر مولفات البيرونى فى الرياضيات و الهيئة و الفلك ۔ و قد قدم له مولفه مقدمة ضمنها كشافاً لمباحثه و موضوعاته و ختم الكتاب الى احدى عشرة مقالة فى كل مقالة عدة ابواب ۔
فيوجد للقانون المسعودى فى مكتبات تركيا نسختان اخريان احدهما فى مكتبة ولى الدين ضمن مكتب " بايزيد العامة تحت رقم 2277 و الاخرى فى مكتبة يوسف آغا بمدينة قونية تحت رقم 792 و مع وجود نسخ القانون المسعودى الصحيحة و الكاملة بتركيا تصبح نسخ لوندن و برليس محدودة الاهمية ۔
و قد نشر المرحوم زكى وليدى طوغان القسم المتعلق بالجغرافيا من القانون المسعودى الباب التاسع و العاشر من المقالة الخامسة نشرا نقديّا مع حواشى و ايضاحات كما نشر ترجمة بعض فصول القانون المسعودى مع حواشيه و ايضاحات ۔
" تحديد نهاية الاماكن لتصحيح مسافات المساكن " النسخة الوحيدة و التى يدعى انها بخط المولف لا تزال محفوظة فى مكتبة الفاتح ضمن المكتبة السليمانية تحت رقم ب 33 فى مجلدة اطرافها محافظة بالجلد و باقى المجلدة بالورق المقوى وهى من كتب السلطان محمود الاول ابعادها 218 × 176 م م وتتكون النسخة من 71 ورقة فى كل صحيفة ثلاثة عشر سطراً و الكتاب يحتوى على اشكال ايضاحية 118 شكلًا ۔

و قد نشر متنها العربي في سنة 1878 و مرة اخرى في سنة 1923 و ترجمته الى اللغة الانجليزية نشرت من لوندره في 1879 ميلادية -

" كتاب استيعاب الوجوه الممكنة في صنعة الاصطرلاب " من مخطوطات مكتبة ايا صوفيا ضمن المكتبة السليمانية ايضا (رقم 2576) مجلدة ظهر ما وار كانها بالجلد و وسط المجلدة بورق مموه - و نسخت ايضا من وقف السلطان محمود الاول و عليها خاتمه و قد رقمت موخرا و ابعادها 1332 × 782 م م و خطها من نوع التعليق خال عموما من النقط و عدد اوراقها 81 ورقة و عدد سطور الصحيفة الواحدة من هذه النسخة 19 سطراً و تحتوى على اشكال توضيحة كثيرة -

و قد ألف البيروني كتابه هذا باسم ابي سهول عيسى بن يحيى الطبري - و موضوع الكتاب - كما هو واضح من عنوانه - هو شرح القواعد و النظريات الهندسية التي يمكن تطبيقها في صناعة آلة الاصطرلاب -

و فاتحة الكتاب بسم الله الرحمان الرحيم كتاب محمد بن احمد البيروني في استيعاب الوجوه الممكنة في صنعة الاصطرلاب ألفه لابي سهول عيسى بن يحيى الطبري -

و آخره

و اذا قد (و) فينا ما وعدنا من امر هيئة الافلاك و هيئة الارض و تكمل منها الكتاب و الله اعلم بالصواب - كتبته ليكون دستوراً في نسخ كتب الهيئة تمت بعون الله و حسن التوفيق -

و لكتاب الاستيعاب المذكور نسخة مخطوطة اخرى مخطوطة في مكتبة جار الله تحت رقم 1451 و هي ضمن المكتبة السليمانية ايضاً -

" القانون المسعودي في الهيئة و النجوم " في مكتبة جار الله تحت رقم 1498 في مجلدة اطرافها محاطة بالجلد و باقيها بالورق المقوى و هذه النسخة من وقف جار الله دخلت في ملكه سنة 1147 حسب ما على وجه الورقة الاولى من النسخة بخط الواقف و عليها ايضا خاتمه -

و ابعاد النسخة 190 × 300 م م وعدد اوراقها 402 و تحتوى هذه النسخة على 236 شكلاً ايضاحياً -

و يقول البيروني انه ألف كتابه هذا " للملك الاجل السيد المعظم خليفة الله و ناصر دين الله و حافظ عباد الله المنتقم من اعداء الله

اليوم القريب و منذ سنوات قليلة مضت كشف بعض الباحثين من الشهاب الاتراك في مكتبة ديار بكر عن وجود رسالة في اخراج مافي قوة الاصطرلاب الى الفعل للبيروني .
و الحديث عن سائر مخطوطات البيروني التي توجد في مختلف المكتبات في تركيا امر صعب و لذلك احب ان اقتصر على ذكر بعض مخطوطاته وهي التي توجد في المكتبة السليمانية فقط .
1) " كتاب الاثار الباقية عن القرون الخالية " يوجد في مكتبة ايا صوفيا (الواقعة الان في المكتبة السليمانية) تحت رقم 2947 نسخة مجلدة مزخرفة الاطراف و بظاهر المجلدة و في سطحها من الجهتين سمة "وقف السلطان محمود الاول" ابعادها الخارجية 160 × 255 م-م و خطها من نوع التعليق و تحتوي على اربعة و تسعين شكلاً و تاريخ كتابتها في سمرقند سنة 36 ـ 1435 = و الورقة الرئيسية منها مذهبة و قسم المكتوب من كل صحيفة منها محاط بجدول بماء الذهب و العناوين و بعض الكلمات مكتوبة بالحبر الاحمر وعدد اوراق النسخة 156 ورقة و سطور الصحيفة الواحدة 25 سطراً .
<u>عنوان الكتاب</u> " كتاب الاثار الباقية عن القرون الخالية " تاليف أبي الريحان محمد بن احمد البيروني الخوارزمي عليه الرحمة . <u>و فاتحة الكتاب</u>
" بسم الله الرحمان الرحيم الحمد لله المتعال عن الاضداد و الا شباه و الصلوة على محمد المصطفى خير الخلق و على آله ائمة الهدى و الحق ."
<u>خاتمته</u> " . . . . . يعرف في اى شهر يكون و عدد الايام الماضية في الشهر الموقع بالحمرة او السواد انشاء الله وحده و هو حسبي كافيا . و بعده بعده الخاتمة تاتي العبارة التالية و جد في نسخة اخرى " تاحد سنى الاسكندر و تنقص منها ألفا و مائة و ستين فان كان الباقي اقل من ستة و تسعين فزد على الباقي اثنين و اطلب من الباقي في السطر الاول الذى للطول و خذ كذلك في العرض فما كان مكتوبا بالسواد فهو من الشهر المكتوب بالحمرة و الله اعلم بالصواب تم الكتاب في سنة تسع و ثلاثين و ثمانمائة ببلدة سمرقند حفظها الله من آلافات " .
ألف البيروني كتابه الاثار الباقية حين اقامته بجرجان و الكتاب يتضمن ابحاثا قيمة في التاريخ و الفلك .

بهذا ويحسن بنا ان نقول ان اللغة العربية لم تستعمل طوال العصور الاسلامية لغة دين فحسب بل كانت في الوقت نفسه اللغة المشتركة التي يشترك العالم الاسلامي المتباعد الاطراف في اعتبارها لغة الثقافة و العلم و هذا ما يجعلني اقتنع بصواب اختياري للتحدث الى حضراتكم باللغة العربية - القيمة العلمية التي تتصف بها مكتبات تركيا من حيث ملئها بالمخطوطات المتعلقة بالثقافة الاسلامية و الشرقية ليست خاصة بمكتبات استانبول بل ان مراكز قديمة و مشهورة للثقافة العلمية في الاناطول تحتوي ايضا على مكتبات بنفس القيمة و رواد هذه المراكز من العلماء و الباحثين يعثرون فيها بين الحين و الحين على كنوز علمية ثمينة اما لانها نسخ وحيدة في العالم او نادرة الوجود او بخط مؤلفها - والاحتمال قوي انه باتساع نطاق البحث و باتمام تنظيم فهارس المخطوطات الموجودة بتلك المكتبات تنظيما علميا ستخرج الى ميادين العلم و المعرفة مادة جديدة لا تزال حتى الان غير معروفة - و يمكن ان يقال ان مكتبات تركيا و بخاصة المكتبة السليمانية قد ادت على الوجه الاكمل و ظيفتها في جمع اكثر مؤلفات البيروني و المحافظة عليها -

فمؤلفاته الفريدة في العالم التي لا ثاني لها و النسخ القديمة و الاصلية التي يمكن الوثوق بها من الوجهة العلمية تحتفظ بها مكتبات تركيا و ليس من المجهول ان بعض مؤلفات البيروني المهمة الموجودة في باريس ايضا كان وطنها الاصلي تركيا ثم انتقلت الى باريس -

و امثلة ذلك كثيرة فاحسن نسخ " القانون المسعودي " من الموجودة في استانبول و قونية و كتاب " تحديد نهايات الاماكن " نسخته الوحيدة و التي يدعى انها بخط المؤلف توجد في استانبول ايضا و كتاب " التفهيم في صناعة التنجيم " الذي الفه البيروني بالعربية ثم ترجمه الى اللغة الفارسية توجد اهم نسخه في استانبول كذلك - اما كتاب الجماهر في معرفة الجواهر " فنسختاه الكاملتان تحتفظ بهما مكتبات استانبول و قيصرية و وجود " كتاب الصيدلة " في مدينة بورسه و حدها امر معروف مشهور عند العلماء -

وفي السنين الاخيرة قد اسفرت بعض البحوث في مكتبات تركيا عن وجود بعض مخطوطات البيروني التي ظلت خافية عن اعين الباحثين حتى

ابوالريحان البيروني - مولفاته المخطوطة بمكتبات استانبول

الدكتور عبدالقادر قره خان

يعتبر ابوريحان محمد بن احمد البيروني - بحق - اكبر نبغاء القرن الخامس الهجري الذين انتجهم العالم الاسلامي احسنهم تحيلا لعصره و اكثر هم و ارقهم انتاجاً -

و اصالة البيروني و نبوغه اكبر من ان يحد هما زمانه و مكانه الذين عاش فيهما بل ان آراءه و نظرياته في كثير من فروع المعرفة قد جعلته من اكبر الاساتذة الرواد المسلمين الذين قدروا قيمة العقل و التجربة في ميدان البحث العلمي في زمانه و فيما بعد زمانه و هناك اكثر من سبب يدفع اهل العلم من تركيا ان يحلوا مكانة البيروني في قلوبهم و عقولهم فيما قد يستشف من عبارات البيروني و كلماته المفترقة في مولفاته المختلفة من انه ينتسب الى احد شعب الامة التركية و احتفاظ مكتبات تركيا في مصاب الاطول عامة و في استانبول خاصة باكثر تراثه العلمي الذي يتمثل في اقوم و اكمل نسخة و اقدمها -

و حياة البيروني العظيم و قسم من رحلاته التي قضاها في شبه الجزيرة الباكستانية الهندية كل اولئك جعلها تمنح تركيا فرصة جميلة لان تذكر (مع من يذكرون) ابا الريحان البيروني بمناسبة مرور الف سنة على مولده بالاجلال و التقدير -

و كلمتي هذه التي رايت ان يكون عنوانها " مولفات البيروني المخطوطة في تركيا عامة و في المكتبة السليمانية خاصة " - سأتلوها على مسامعكم باللغة العربية - و لست آتيا اليكم بجديد حين اقول ان ابا الريحان البيروني - مع علمه بلغات اخرى غير اللغة العربية - كان ممتلئا بحب اللغة العربية كتب بها اكثر مولفاته -

24) Al-Biruni's Commemoration Volume, Page 256 Published by Iran Society, Calcutta, 1951.

25) نگار (لکھنو) ص 51 بابت جنوری / فروری 1948ء

26) بیرونی و البیرونی مطبوعہ اورینٹل کالج میگزین بابت مئی 1943ء

27) " تاریخ عالم آرا عباسی " مولفہ اسکندر بیگ ترکمان مرتبہ ایرج افشار مطبوعہ تہران مملوکہ پروفیسر ڈاکٹر ریاض الاسلام صدر شعبہ تاریخ عمومی جامعہ کراچی -

28) تاریخ عالم آرا عباسی مولفہ اسکندر بیگ ترکمان مرتبہ ایرج افشار مطبوعہ تہران مملوکہ پروفیسر ڈاکٹر ریاض الاسلام

29) " ذیل عالم آرا عباسی " ملخصا " ص 200 طبع تہران بحوالہ ضمیمہ اورینٹل کالج میگزین مئی 1943ء لاہور

30) تتمہ صوان الحکمہ ص 63 مرتبہ محمد شفیع مطبوعہ پنجاب یونیورسٹی لاہور 1935ء

31) کشف الظنون جلد دوم کالم 1664 مطبوعہ استنبول 1941ء

32) ہدیۃ العارفین جلد دوم ص 36 مطبوعہ استنبول 1951ء

33) الفہرست ص 138

34) معجم الادبا جلد دوم ص 59 مطبوعہ مصر و معجم البلدان جلد اول ص 11 مطبوعہ بیروت 1955ء

11) کتاب المسالک و الممالک مولفه ابن حوقل (متوفی 367ھ)
مطبوعہ 1773ء

12) کشف الظنون مولفه حاجی خلیفه کالم 9 حلد اول مطبوعہ
استنبول 1941ء

13) ایم ریناد بحواله نگار (لکھنو) بابت جنوری فروری 1948ء

14) معجم المطبوعات العربیه و المعربه ص 615 مرتبه یوسف الیاس
سرکیس مصر 1928ء

15) نزهت الخواطر حلد اول ص 88 مطبوعہ حیدرآباد دکن 1947ء

16) کتاب المسالک و الممالک مولفه ابوعبد اللّه محمد الادریس
بحواله نگار (لکھنو) جنوری فروری 1948ء

17) تحفة الکرام حلد سوم از علی شیر قانع بحواله الفهرست

18) فتح نامه سندھ " المعروف به " چچ نامه " (منهاج المسالک)
از محمد علی بن حامد کوفی ص 115 ـ 117 مرتبه ڈاکٹر عمر بن
محمد داؤد پوته مطبوعه مطبع لطیفی دهلی 1939ء

19) تاریخ معصومی ص 21ـ 22 مولفه سید محمد معصوم بھکری
مرتبه ڈاکٹر داؤد پوته مطبوعه بمبئی 1938ء

20) (1) Hi-tory of the rise of Mohammaden power in India Vol. 1 P. 113 by John Briggs, Calcutta, 1829 (Archives library, harachi).

21) (2) The hi-tory of India as told by its own Historians, Vol. 11 P. 1 By Sir H. M. lIlliot. London 1869, (Anjuman Taraqqi-e-Urdu library Karachi).

22) کتاب الانساب ص 98 از عبد الکریم سمعانی مرتبه د ـ س مارگولیتهه
(D. S. MARGOLIOUTH) مطبوعه لندن مملوکه کراچی
یونیورسٹی لائبریری

23) معجم الادبا حلد ششم ص 308 مطبوعه مصر طبع دوم مملوکه
کراچی یونیورسٹی لائبریری ـ

تاریخی اور جغرافیائی ماخذوں سے ظاہر ہے خوارزم کے جنوبی خراسان کے شمالی علاقے میں واقع تھا عہد صفویہ میں البتہ یہ واضح طور پر خراسان کا ایک حصہ تھا ۔

حوالے

1) دائرۃ المعارف اسلامیہ جلد پنجم ص 261 مطبوعہ لاہور

2) " البیرونی " مولفہ سید حسن برنی مطبوعہ علی گڑھ 1927ء طبع دوم

3) ابوریحان محمد بن احمد خوارزمی بیرونی مطبوعہ تہران 1324 خورشیدی

4) لغت نامہ دہخدا جلد دوم ص 460 مطبوعہ تہران 1325 خورشیدی

5) حواشی چہار مقالہ ص 193 تا ص 197 مرتبہ عبدالوہاب قزوینی مطبوعہ لائڈن 1909ء

6) مقدمہ آثار الباقیہ از ڈاکٹر ایڈورڈ سخاو مطبوعہ لبزگ 1928ء مملوکہ کراچی یونیورسٹی لائبریری

7) AL-BIRUNI'S INDIA BY DR. Edward Sachau, London, (Archives, library, Karachi, Pakistan).

8) عیون الانباء فی طبقات الاطباء ص 30 مطبوعہ 1882 میلادی مصر مملوکہ کراچی یونیورسٹی لائبریری

9) اخبار الحکما (قلمی) بحوالہ مولانا عبدالسلام ندوی مقالہ مشمولہ البیرونی یادگار مجلد ص 251 مطبوعہ مجاب ایران سوسائٹی کلکتہ ۔ 1951ء

10) تقویم البلدان ص 246 تا 348 مرتبہ ایم رینود مطبوعہ 1840ء مملوکہ کراچی یونیورسٹی لائبریری ۔

کسی وقت خوارزم کے جنوبی اور خراساں کے شمالی علاقے میں موجود تھے۔

یہی نہیں بعض اس سے بھی قدیم تر کتابوں میں بھی بیروں کا ذکر ملتا ہے۔ امام علی بن زید البیہقی مشہور تذکرہ نگار ہے اور البیرونی کے قریبی زمانے سے تعلق رکھتا ہے اس نے 565 ھ میں " تتمہ صوان الحکمہ " کے نام سے ایک کتاب لکھی تھی مولوی محمد شفیع نے اسے مرتب کرکے پنجاب یونیورسٹی کی جانب سے شائع کر دیا ہے۔ اس میں البیرونی کا ذکر اس طور پر ملتا ہے۔

ابوریحان البیرونی من احلاء الہند سین و قد سافر فی
بلاد الہند اربعین سنۃ صنف کتبا کثیرۃ ۔ رایت اکثر ھا
بخطہ و بیروں التی ھی منشاؤہ مولدہ بلدۃ طیبۃ فیھا
غرائب و عجائب و لا غروفان الدر ساکن الصدف و قال
فی تحقیق امر منازل القمر (30)

یہ عبارت اس بات کی بیّن شہادت ہے کہ " بیروں " ایک شہر کا نام اور البیرونی کا آبائی وطن ہے لیکن عبدالحیؐ حبیبی نے اپنے مقالے میں اس سے بھی قدیم تر ایک ماخذ ترجمہ " اشکال العالم " مترجمہ علی ابن عبدالسلام کا حوالہ دیا ہے۔ مقالہ نگار کے خیال میں یہ کتاب ابوالقاسم احمد الجیہانی کی مشہور کتاب جغرافیہ " المسالک و الممالک " کا فارسی ترجمہ ہے اور اس کا ایک قلمی نسخہ کابل میں ان کی نظر سے گذرا ہے۔ ابوالقاسم احمد بن الجیہانی امیر خراساں کا وزیر اور اپنے زمانے کا نامور فلسفی و منجم اور جغرافیہ داں تھا۔ اس کا انتقال البیرونی کی پیدائش سے پانچ سال بعد 367 ھ میں ہوا ہے اس کی مشہور کتاب " المسالک و الممالک " کا ذکر حاجی خلیفہ (31) اسماعیل پاشا (32 ابن ندیم (33) اور یاقوت (34) وغیرہ نے کیا ہے۔ لیکن افسوس کہ الجیہانی کی اصل کتاب المسالک و الممالک مفقود ہے۔ بہر حال اس کے فارسی ترجمے " اشکال العالم " میں بیروں کا ذکر موجود ہے۔ اور اس بات کو تقویت پہنچاتا ہے کہ بیروں ایک خاص قصبے یا شہر کا نام تھا اور یہی البیرونی کی جائے پیدائش ہے۔ یہ شہر یا گاؤں جیسا کہ بعض قدیم

حراسان گورلو سلطان حاکم ولایت دروں است (ص 1088 جلد سوم)
4۔ امرا عبداللہ خاں کہ در حراسان بودند حسب الامر کمر همت بتسخیر ولایت لنسا و آبیورد و دروں رباعباد چست بسته (ص 549 جلد دوم)
5تا آنکه در حراسان طغیان اوریکیه واقع شده ولایت لنسا و ابیورد ودروں و باعباد بتصرف امرائے اوریکیه قرار گرفت (ص 581 جلد دوم) (28)

غرضکہ تاریخ عالم آرا عباسی میں ایک جگہ نہیں متعدد جگہ " دروں " کا ذکر آیا ہے - اور صاف پتہ چلتا ہے کہ دروں کسی خاص قصبے یا شہر کا نام تھا اور اس میں ایک قلعہ بھی تھا اسلئے کہ قلعہ دروں کا ذکر بھی اکثر جگہ آیا ہے - یہی صورت سیروں کی ہے - تاریخ عالم آرا کے تکملہ کے بعد منشی اسکندر بیگ نے شاہ عباس کی وفات اور شام میرزا کی تخت نشینی کے بعد کے حالات بھی " ذیل تاریخ عالم آراعباسی " کے نام سے لکھنے شروع کئے تھے - لیکن 1043 ھ میں مولف کے انتقال کے سبب اسکا تکملہ نہ ہوسکا بہر حال " ذیل عالم آرا عباسی " کو احمد سہیلی خوانساری نے " تاریخ جلد بریں " مولفہ محمد یوسف کے ایک حصے کے ساتھہ 1317 میں تہران سے شائع کردیا ہے - اس میں دروں و قلعہ دروں کے ساتھہ قلعہ سیروں کا بھی ذکر حراسان کے احوال میں اس طور پر آیا ہے -

" عرب محمد خان ابن خان حاجم خان اوزبک والی خوارزم از استیلائے مطنداں ار ملک موروث برآمده و باستانۂ شاه عباس آمد و کمک واپس به سلطنت موروث رسید بعد از وفات عرب محمد خان در اولاد ش نزاع افتاد و اسعندیار سلطان بدرگاه عباسی رفت و به معاصدت بدر بار صفوی پس خوارزم را بتصرف آورد یک حصه را به برادر خود ابوالغازی داد او بقصد تسخیر ولایت مروولنسا و دروں اظهار موافقت ایشان نموده کس نزد ابو الغازی سلطان فرستاده اورا بامدن آنجا ترغیب نموده و وعده قلعه سیروں داد (29)

تاریخ عالم آرا عباسی اور اس کے ذیل میں دروں و سیروں کے یہ اندراجات اس امر کا ثبوت ہیں کہ یہ دونوں الگ الگ مقامات کے نام ہیں اور

ے اس کی مراد مضافاتی علاقہ نہیں بلکہ خاص جگہ یا شہر سے ہے ۔

دوسرا اہم سوال اس جگہ یہ پیدا ہوتا ہے کہ جب اہل خوارزم ،
وارزم سے باہر کے سارے باشندوں کو بیرونی کہتے تھے تو یہ نسبت صرف
وریحان محمد بن احمد ہی کے نام کے ساتھ کیوں استعمال کی گئی
سی دوسرے شخص یا معاصر مثلاً بو علی سینا ، ابوسہل یحییٰ ، ابوالخیر
ر ابو نصر وغیرہ کے نام کے ساتھ کسی نے کبھی بیرونی کا لفظ استعمال
وں نہیں کیا جب کہ یہ سب خوارزم کے باہر کے رہنے والے تھے اور ان
ا قیام خوارزم میں تھوڑے ہی عرصے رہا ہے ۔ یہ ایسی باتیں ہیں جن
ے سبب یہ بات دل کو نہیں لگتی کہ " بیروں " سے مراد خوارزم کا سارا
یرونی علاقہ ہے اور اہل خوارزم اسی نسبت سے ابوریحان کو البیرونی کہتے
ہے بلکہ حقیقت یہ معلوم ہوتی ہے کہ بیروں ایک خاص شہر یا قصبے کا
نام ہے اور البیرونی کا مسقط الراس ہے ۔ اس اہم پہلو کو البیرونی کے مقالہ
نگاروں میں سے صرف عبدالحئی (26) نے ایک مضمون میں موضوع گفتگو
بنایا ہے اور بیروں کے سلسلے میں بعض نئے ماخذوں کی طرف ہماری
توجہ مبذول کرائی ہے ۔

تاریخ عالم آرائے عباسی " مولفہ منشی اسکندر بیگ (27)
(مرقومہ 1025 ھ تا 1038 ھ) میں جہاں مہمات خاندان صفویہ کے
سلسلے میں خراسان و خوارزم کے نواح کا ذکر آیا ہے وہاں دوسرے شہروں
کے ساتھ دروں و بیروں نام کے دو خاص مقامات کا بھی ذکر ملتا ہے ۔
پہلے دروں کے سلسلے کے چند حوالے دیکھئے ۔

1 ۔ نور محمد خان سفاہت و بے عقلی کردہ از غایت تعلق کہ بنسا و دروں
داشت قبل از آں کہ مطلب او سعی عبداللہ خان بحصول انجامد نوو
راپیشکش کردہ بوبہ تصرف گماشتگان عبداللہ خان داد (ص 452
جلد دوم)

2 ۔ اباعبدالمومن خان خون خاطر از مہم ابیورد و نسا و باغباد و دروں و آں
حدود جمع کردہ در خیر تسخیر متوقع قلعہ نیشاپور گشتہ (ص 464
جلد دوم)

3 ۔ یوسف سلطان حاکم خبوشان خراسان جمشید سلطان حاکم ابیورد

سے خوارزم میں بہت کم قیام کیا اور اہل خوارزم اجنبی کو بیرونی کہتے ہیں گویا جب وہ بہت دنوں تک اس سے الگ رہا تو وہ اجنبی ہوگیا لیکن میرا خیال ہے کہ وہ دیہات کا باشندہ تھا یعنی وہ شہر سے باہر کا رہنے والا تھا ۔

ان بیانات سے پتہ چلتا ہے کہ یاقوت اور سمعانی دونوں اس امر پر متفق ہیں کہ بیرون کسی خاص جگہ یا خاص شہر کا نام نہیں ہے بلکہ اس سے مراد شہر خوارزم کے باہر کا سارا مضافاتی اور دیہی علاقہ ہے اور چونکہ خوارزم کے باشندے خوارزم سے باہر رہنے والوں کو اجنبی اور بیرونی سمجھتے تھے ۔ اسلئے ابوریحان محمد بن احمد کو بیرونی کہاجانے لگا ۔

بعد کے سوانح نگاروں نے بھی عام طور پر یہی رائے ظاہر کی ہے بلکہ یوں کہنا چاہئیے کہ البیرونی کی وجہ تسمیہ کے سلسلے میں انہوں نے یاقوت اور سمعانی کے بیانات کو من و عن قبول کرلیا ہے ۔ چنانچہ سید حسن برنی ، علی اکبر دہخدا ، ڈاکٹر ایڈورڈ سخاو ، مولانا عبدالسلام ندوی (24) علامہ نیاز فتح پوری (25) اور دائرۃ المعارف اسلامیہ کے مولفین نے یاقوت و سمعانی ہی کے اقوال کو حرف آخر جانا ہے اور اس بارے میں مزید تحقیق کی ضرورت محسوس نہیں کی ۔ حالانکہ اس سلسلے میں دو ایک باتیں خاص طور پر توجہ طلب تھیں ۔

کہا جاتا ہے کہ اہل خوارزم ۔ خوارزم کے باہر کے باشندوں کو بری ، دیہاتی ، مضافاتی اور بیرونی کہہ کر پکارتے تھے ۔ گویا یہ کلمہ تعظیمی نہیں تحقیری تھا اور اہل خوارزم انہیں اپنے سے کم تر اور حقیر خیال کرکے بیرونی کہتے تھے ۔ ایسی صورت میں یہ بات قابل یقین نہیں کہ ابو ریحان نے اس تحقیری کلمہ کو اپنے نام کا جزو بنانا پسند کیا ہوگا ۔

اس طرح کے صفاتی نام عام طور پر دوسروں کے دئیے ہوئے نہیں ہوتے بلکہ شعرا و مصنفین خود اپنی جائے پیدائش و سکونت یا نسل و قومیت کو ظاہر کرنے اور اس طرح اپنے نام کو اس قسم کے دوسرے ناموں سے ممتاز کرنے کیلئے انتخاب کرلیتے ہیں ابوریحان البیرونی نے بھی یقیناً یہی کیا ہے ۔ یعنی اس نے دانستہ بیروں سے اپنی نسبت ظاہر کی ہے اور بیروں

Masoody in reward for which he was presented an elephant's load of silver." (1).

ایچ ایم ایلیٹ نے اس تبدیلی پر اظہار حیرت کرتے ہوئے لکھا ہے کہ
"In Brigg's Freshta tne name is strongly preveted into Anvury Khan" (2).

بعض یورپین مورخین " برگس " کی تقلید میں اس غلطی کو دہراتے رہے ہیں اور جنہوں نے غلطی کو محسوس کرلیا ہے ۔ انہوں نے اس کی ذمہ داری برگس کے بجائے غریب فرشتہ پر ڈال دی ہے ۔ لیکن بقول حکیم محمد سعید البیرونی کے سلسلے میں اس سے بھی بڑا لطیفہ یہ ہے کہ پچھلے دنوں ہندوستان میں البیرونی پرجو سیمنار ہوا اس میں ایک محقق نے " بیرونی " کے ب پر ایک کے بجائے دو نقطے پڑھ لئے اور بیرونی کو بڑی آسانی سے تیروتی ثابت کردیا ۔

ان لطائف سے قطع نظر آئیے لفظ بیروں اور بیرونی کے سلسلے میں دوسرے گروہ کے تذکرہ نگاروں کی رائے کا جائزہ لیں ۔ عبدالکریم سمعانی نے لکھا ہے " البیرونی بکسرۃ الباء الموحدہ و سکون الیاء آخر الحروف و ضمۃ الراء وبعدہ الواو وفی آخرہا النون ہذا نسبۃ الی خارج خوارزم فان بہا من یکون من من خارج البلد من نفسہا یقال لہ فلان بیرونی" (22)

یعنی "بیرونی کی نسبت بیروں خوارزم کی طرف ہے کیونکہ جو لوگ خود خوارزم کے باشندے نہیں ہوتے بلکہ انکے باہر کے باشندے ہوتے ہیں ان کو بیرونی کہا جاتا ہے کم و بیش اسی طرح یاقوت کا بیان ہے کہ

" محمد بن احمد ابوریحان البیرونی الخوارزمی وہذہ النسبۃ معناہا البرانی لان بیروں و بالفار سیۃ معناہ برا و سالت بعض الفضلاء عن ذالک فزعم ان مقامہ بخوارزم کان قلیلا و اہل خوارزم یسمون الغریب بہذا الاسم کانہ لما طالت غربتہ عنہم صار غریباً و ما اظنہ یراد بہ الا انہ من اہل الرستاق یعنی انہ من خارج البلد (23

یعنی محمد بن احمد ابوریحان البیرونی و الخوارزمی اور اس نسبت کے معنی باہر والے کے ہیں ۔ کیونکہ فارسی میں بیروں کے معنی باہر کے ہیں ۔ میں نے بعض فضلا سے انکے متعلق دریافت کیا تو بیان کیا کہ اس

کے بعض مصنفین تک بیروں کو سندھ کا ایک شہر سمجھتے ہیں - چنانچہ مصر کی معجم المطبوعات اور مولوی عبدالحئی کی نزہۃ الخواطر میں لکھا ہے کہ —

" البیرونی بیروں سے منسوب ہے اور بیروں سندھ کا ایک شہر ہے " (14 - 15) غرض کہ بیروں کے سندھ میں ہونے کا مغالطہ ابتدا سے لیکر اب تک کسی نہ کسی صورت میں موجود ہے - یہ مغالطہ صرف ایک نقطے کے اوپر نیچے ہوجانے سے پیدا ہوا ہے - سندھ قدیم کے جغرافیائی حالات میں بیروں نہیں " نیروں " یا "نیروں کوٹ " کا سراغ ملتا ہے جو کہ موجودہ حیدرآباد کی جگہ واقع تھا - الادریسی (493 تا 565 ھ) نے دریائے مہران کے ذکر میں لکھا ہے کہ وہ نیروں سے گزرتا ہوا سمندر میں گرتا ہے (16) تحفۃ الکرام (17) چچ نامہ (18) اور تاریخ معصومی (19) میں بھی " نیروں " ہی کا ذکر آیا ہے -

ہوا یہ کہ " نیروں " میں نون کے نقطے کو کسی قدیم جغرافیہ نگار غالباً ابن حوقل نے غلطی سے اوپر کے بجائے نیچے پڑھ لیا اور نیروں بہت آسانی سے بیروں ہوگیا اور یہیں سے یہ مغالطہ پیدا ہوا کہ " بیروں " سندھ کا ایک مشہور شہر اور البیرونی کا مسقط الراس ہے - حالانکہ البیرونی کا سندھ کے نیروں یا بیروں سے دور کا بھی کوئی تعلق نہیں ہے اگر ایسا ہوتا تو البیرونی کم از کم کتاب الہند میں اس کا تذکرہ ضرور کرتا -

البیرونی کے حالات میں نیروں و بیروں کی قسم کا ایک اور مضحک پہلو بعض یورپین مصنفین نے پیدا کیا ہے - جس طرح نیروں کے نون کے نقطے کو اوپر کے بجائے نیچے پڑھ لیا گیا بالکل اسی طرح تاریخ فرشتہ کے مترجم جان برگس (JOHN BRIGGS) نے ابوریحان کے ب کے نقطے کو نیچے کے بجائے اوپر پڑھ لیا اور " ابوریحان " کو "انوریحان " کردیا ہے - برگس نے مسعود کے درباری عالموں اور دانشوروں کا ذکر کرتے ہوئے لکھا ہے کہ -

"Among the moft celebrated, we reckon Anvury Khan Khawarizmy, ε great philosopher and astronomer, who wrote an excellant treatise upon astronomy called

سوالات اوپر اٹھائے گئے ہیں ان کا شافی جواب کہیں نہیں دیا گیا ۔
نتیجۃً البیرونی کی جائے پیدائش کا قضیہ ہنوز توجہ طلب ہے ۔

البیرونی کے قدیم تذکرہ نگاروں نے بیروں و بیرونی کے سلسلے میں مختلف باتیں کہی ہیں یہ باتیں کارآمد بھی ہیں اور کہیں کہیں حد درجہ دل چسپ بھی ۔ تذکرہ نگاروں کے بیانات پر نظر ڈالنے سے اندازہ ہوتا ہے کہ وہ بیروں کے بارے میں دو خاص گروہوں میں بٹے ہوئے ہیں ۔ ایک رائے وہ ہے جو ابن ابی اصیبعہ نے عیون الانباء میں، شہر روری نے اخبار الحکما میں ، ابو الفدا اسماعیل بن علی نے تقویم البلدان میں ، ابن حوقل ابو القاسم نے المسالک و الممالک میں اور حاجی خلیفہ نے کشف الظنون میں ظاہر کی ہے دوسری رائے وہ ہے جس کا اظہار صاحب کتاب الانساب عبد الکریم سمعانی اور صاحب معجم الادبا شہاب الدین ابوعبد اللہ یاقوت الرومی اور ان کی تقلید میں آج تک کے دوسرے تذکرہ نگاروں نے کیا ہے ۔ آئیے دیکھیں کہ پہلا گروہ اس سلسلے میں کیا کہتا ہے ۔ ابن ابی اصیبعہ کا خیال ہے کہ

" ہو الاستاد ابو الریحان بن احمد البیرونی منسوب الی بیرون وہی مدینۃ فی السند (8)

یعنی " بیروں " سندھ کا ایک شہر ہے اور البیرونی اسی طرف منسوب ہے ۔ بیروں کے متعلق علامہ شمس الدین محمد بن محمود شہرروری کا بیان ہے کہ

" ابوریحان محمد بن احمد بیروں میں پیدا ہوا جو سندھ کا نہایت خوبصورت شہر ہے " (9)

گویا ابن ابی اصیبعہ اور شہر روری کی رائے ایک ہے دونوں بیروں کو سندھ کا ایک شہر اور البیرونی کو سندھی سمجھتے ہیں ۔ اسی طرح ابو الفدا (10) ابن حوقل (11) اور حاجی خلیفہ (12) نے بھی بیروں کا تعلق سندھ سے ظاہر کیا ہے ۔ فرانسیسی مورخ ایم رینا د (M. Reinaud) نے بھی یہی لکھا ہے (13) حتیٰ کہ بیسویں صدی

ابوریحان محمد بن احمد البیرونی کی جائے پیدائش کا قضیہ

ڈاکٹر فرمان فتح پوری

ابو ریحان محمد بن احمد دنیائے علم و دانش میں البیرونی کے نام سے مشہور ہے۔ اس نام سے اتنی بات تو واضح ہے کہ لفظ "بیرون" سے نسبت رکھنے کے سبب ہی اسے بیرونی یا البیرونی کہا جاتا ہے۔ لیکن بعض نے اسے بیرونی کے بجائے خوارزمی لکھا ہے اور بعض نے بیرونی و خوارزمی دونوں۔ پھر یہ بھی ہے کہ بعض نے بیروں سندھ میں بتایا ہے اور بعض نے خوارزم کے سارے بیرونی علاقے کو بیروں کا نام دیا ہے۔ سوال یہ پیدا ہوتا ہے کہ لفظ "بیرون" کی اصل حقیقت کیا ہے۔ آیا یہ لفظ اس کے نام کے ساتھ بہ اعتبار لغت باہری (outsider) کے معنی میں استعمال ہوا ہے یا وہ کسی خاص جگہ کا نام ہے اور البیرونی کی جائے پیدائش ہے۔ اگر ایسا ہے تو وہ کہاں واقع ہے۔ سندھ میں یا خوارزم میں یا دونوں سے الگ۔ اس وقت میری گفتگو کا موضوع انہیں سوالوں کے جواب کی تلاش ہے۔

البیرونی کے حالات زندگی صرف چند مصنفین نے قدرے تفصیل سے لکھے ہیں اردو میں دائرۃ المعارف اسلامیہ کے مولفین (1) اور سید حسن برنی (2) نے، فارسی میں علی اکبر دہ خدا (3 ـ 4) اور علامہ عبدالوہاب قزوینی (5) نے اور مغربی مصنفین میں ڈاکٹر ایڈورڈ سخاؤ (Dr. Edward Sachau) (7 ـ 6) نے بہت کار آمد اطلاعات بہم پہنچائی ہیں۔ اس سے انکار نہیں کہ ان بزرگوں نے البیرونی کے حالات جمع کرنے میں بڑی عرق ریزی و جانکاہی سے کام لیا ہے اور اپنی تالیفات و مقالات میں قدیم و جدید مآخذ کی طویل فہرست دیکر مزید تحقیق کا راستہ بہت ہموار کر دیا ہے۔ بایں ہمہ بیروں اور بیرونی سے متعلق جو

جواہرات :

البیرونی نے زمین کی تہوں میں ہیروں اور دوسرے قیمتی پتھروں کی پیدائش پر بڑی تحقیق کی ہے اور اپنا نتیجہ فکر " کتاب الجماہر فی معرفۃ الجواہر " کے عنوان سے پیش کیا ہے - البیرونی نے جس طرح سے قیمتی پتھروں اور دھاتوں کی ساخت کا مطالعہ کیا ہے وہ ان کے ماہر ارضیات ہونے پر دال ہے - اس نے ارضیات کے موضوع پر اس وقت قلم اٹھایا جس وقت یورپ اس فن سے نا آشنا تھا -

آرٹی زن کنوئیں :

البیرونی نے آرٹی زن کنوؤں کے متعلق جو تحقیق کی ہے دور حاضر کی تحقیق اس کے عین مطابق ہے - اس کا کہنا ہے کہ یہ کنوئیں عموماً ایسے پہاڑی علاقوں میں ہوتے ہیں جہاں زیر زمین غیر جاذب چٹانیں پانی کو نیچے جانے سے روک لیتی ہیں اور پانی کی سطح بلند ہونا شروع ہو جاتی ہے اور اس کے ساتھ اس کا دباؤ بھی بڑھنے لگتا ہے اور پھر جس جگہ زمین قدرے نرم ہوتی ہے وہ پانی فوارے کی شکل میں پھوٹ نکلتا ہے -

حرف آخر :

البیرونی معصوم عن الخطا نہیں تھا اس سے بھی بعض غلطیاں ہوئی ہیں اس نے اپنے تجربات مشاہدات اور مطالعے کی بنیاد پر جو نظریات قائم کئے تھے وہ جدید تحقیق کے عین مطابق ہیں اور جہاں اس نے ہندوؤں کی تحقیق یا ان کی فراہم کردہ معلومات پر اعتماد کیا ہے وہیں اس نے غلطی کی ہے مثلاً اس نے ہندوؤں کی روایات پر اعتماد کرکے صوبہ سندھ کا پھیلاؤ خط استوا تک لکھا ہے جو صریحاً غلط ہے - اسی طرح ہندوستان کے بعض دریاؤں کے دھانوں کے ضمن میں بھی ہندوؤں نے اسے غلط معلومات فراہم کی تھیں جو البیرونی کی کتابوں میں راہ پاگئی ہیں -

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شمالی پر جس قدر طویل دن ہوگا قطب جنوبی پر اسی قدر طویل رات ہوگی اور قطب شمالی پر جس قدر طویل رات ہوگی قطب جنوبی پر اسی قدر طویل دن ہوگا ۔ البیرونی نے اس بات کا ذکر بھی کیا ہے کہ قطبین پر سمت کا تعین کوئی آسان بات نہیں ہے ۔

گرہن :

گرہن کے متعلق صدیوں میں بڑی مضحکہ خیز روایات مشہور ہیں البیرونی نے ان تمام روایات کی تردید کرتے ہوئے انہیں حقیقت حال سے آشنا کیا ۔ اس نے انہیں بتایا کہ جب سورج زمین اور چاند گردش کرتے ہوئے ایک مدار پر آجاتے ہیں تو زمین کا سایہ چاند پر پڑنے سے اسے گرہن لگ جاتا ہے اور جب کبھی چاند گردش کرتے کرتے زمین اور سورج کے درمیان آجاتا ہے تو سورج کو اہل زمین کی نظروں سے چھپالیتا ہے اور یوں سورج کو گرہن لگ جاتا ہے ۔ اس نے اپنے نظریے کی حمایت میں یہ دلیل دی ہے کہ چاند گرہن کبھی بھی مغرب کی سمت سے شروع نہیں ہوتا اور اسی طرح سورج گرہن کبھی مشرق کی سمت سے نہیں شروع ہوتا ۔ البیرونی اس حقیقت سے بھی واقف تھا کہ کرہ ارض پر بسنے والے لوگوں کو مختلف علاقوں میں ایک سا گرہن نظر نہیں آتا اور بعض علاقوں میں کم اور بعض میں زیادہ دکھائی دیتا ہے ۔

کشش ثقل :

البیرونی کی تحریریں پڑھنے کے بعد ان لوگوں کی لاعلمی ظاہر ہو جاتی ہے جو نیوٹن کو کشش ثقل کے نظریہ کا واضع قرار دیتے ہیں ۔ کشش ثقل کا ذکر کرتے ہوئے البیرونی رقمطراز ہے کہ ہر وزن رکھنے والی چیز زمین کے مرکز کی طرف کھنچتی ہے اور اگر کوئی حائل موجود نہ ہو تو زمین پر گرتی ہے ۔ البیرونی زمین کی اس کشش کو زمین کی فطرت قرار دیتا ہے ۔

جوں جوں دور ہوتے جائیں پتھر چھوٹے ہوتے جاتے ہیں اور سمندر تک پہنچتے پہنچتے ریت بن جاتے ہیں ۔ اگر اس پر غور کریں تو اس نتیجے پر پہنچیں گے کہ کبھی ہندوستان ایک سمندر تھا اور رفتہ رفتہ دریاؤں کے ساتھ آنے والی مٹی اور ریت نے اسے پر کردیا ۔

جھیل سانبھر :

البیرونی لکھتا ہے کہ جس طرح بحیرۂ خزر اور بحیرۂ ارال چاروں طرف سے خشکی میں گھرے ہوئے ہیں اسی طرح کسی زمانے میں راجستھان کی جگہ بھی سمندر تھا اس سمندر میں جو دریا گرتے تھے جغرافیائی تبدیلیوں سے ان کا رخ بدل گیا یا پھر وہ خشک ہوگئے ۔ سورج کی تمازت سے اس سمندر کا پانی بخارات کی شکل میں تبدیل ہونے لگا اور رفتہ رفتہ یہ سمندر سمٹنے لگا اور اس کی جگہ ریت اور چٹانیں نمودار ہونے لگیں ۔ اب یہ سمندر سمٹ سمٹا کر جھیل سانبھر کی صورت میں باقی رہ گیا ہے ۔ اس جھیل کا پانی اتنا نمکین ہے کہ اسے گرم کرکے اس سے نمک بناتے ہیں جو سانبھری نمک کے نام سے موسوم ہے ۔

البیرونی کی یہ تحقیق کس قدر صحیح ہے کہ دن اور رات صرف زمین کے لئے ہیں اور صرف اہل زمین وقت کا شمار دن اور رات سے کرتے ہیں ورنہ ساری کائنات میں وقت کا شمار دن اور رات سے نہیں ہوسکتا ۔

قطبین پر جو طویل دن اور راتیں ہوتی ہیں البیرونی ان کی حقیقت سے باخبر تھا ۔ ایک بار ایسا ہوا کہ سلطان محمود کے سامنے ایک شخص نے کہا کہ وہ ایسے علاقے سے ہوکر آیا ہے جہاں کئی کئی ماہ کا دن اور کئی کئی ماہ کی رات ہوتی ہے ۔ سلطان نے اس شخص کو ملحد اور زندیق سمجھتے ہوئے اس کے قتل کا حکم صادر کیا ۔ یہ اس شخص کی خوش قسمتی تھی کہ اس وقت البیرونی وہاں موجود تھا اور اس نے سلطان کے سامنے قطبین پر طویل دن اور رات کی حقیقت واضح کی اور یوں گویا اس غریب کو دوبارہ زندگی ملی ۔ البیرونی کا یہ کہنا ہے کہ قطب

درختوں کی چوٹیوں پر کوڑا کرکٹ گھونسلوں کی طرح نظر آتا ہے۔

البیرونی نے گنگا جمنا سرسوتی اور سرندا کے نہ صرف یہ کہ صحیح راستے بتائے ہیں بلکہ ان کے دہانوں کے متعلق بھی بالکل صحیح معلومات بہم پہنچائی ہیں ان بڑے دریاؤں کے علاوہ البیرونی نے اور بھی متعدد دریاؤں کے راستے منابع اور دہانے تحریر کئے ہیں۔

دریائے نیل :

دریائے نیل کا منبع مدتوں تک جغرافیہ دانوں کے درمیان مابہ نزاع رہا ہے آج کل یہ خیال پایا جاتا ہے کہ سب سے پہلے نیل کا منبع مشہور سیاح لیونگسٹون (Livingstone) نے دریافت کیا تھا۔ جو لوگ دریائے نیل کے منبع کی دریافت کا سہرا لیونگسٹون کے سر باندھ رہے ہیں وہ اس حقیقت سے قطعاً بے خبر ہیں کہ البیرونی ایک ہزار سال پہلے جبل قمر کو نیل کا منبع بتاچکا ہے۔

برصغیر پاک و ہند :

البیرونی کا یہ نظریہ کس قدر صحیح ہے کہ کسی زمانے میں پنجاب اور سندھ کے میدانوں کی جگہ سمندر ٹھاٹھیں مارا کرتا تھا۔ ہمارے دور کے سائنسدان بڑی تحقیق و کاوش کے بعد اس نتیجے پر پہنچے ہیں کہ ہمالیہ سے نکلنے والے دریا اپنے ساتھ ہر برس بہت بڑی مقدار میں ریت اور مٹی بہا کر لاتے رہے ہیں اس عمل کے نتیجے میں سمندر پٹنے لگا اور زمین ابھرنے لگی۔ یہ عمل برسہا برس جاری رہا سمندر پیچھے ہٹتا گیا اور پنجاب اور سندھ کے میدان تشکیل پاتے رہے۔ اس ضمن میں البیرونی لکھتا ہے کہ اگر تم ہندوستان کی زمین کو اپنی آنکھوں سے دیکھو اور اس کی ساخت پر غور کرو تو اس نتیجے پر پہنچوگے کہ زمین کے نیچے گول پتھر ملتے ہیں خواہ کتنی ہی گہرائی پر کھود و پہاڑوں کے قریب یہ پتھر بڑے ہوں گے جہاں دریا تیز رفتار ہیں وہاں پتھر چھوٹے ہیں پہاڑوں سے

مہادیو کا لنگ ایک ایسے مقام پر نصب تھا جہاں مد کے وقت پانی آجاتا
تھا ۔ مندر کے پروہت سادہ لوح ہندوؤں کو یہ باور کرایا کرتے تھے کہ
سمندر کا پانی روز و شب میں دو بار مہادیو کے لنگ کو اشنان کرانے آتا ہے
البیرونی نے ہندوؤں کے اس مفروضے کا بری طرح سے مذاق اڑایا ہے ۔
اسی طرح اس نے اپنی تحریروں میں جا بجا ہندوؤں کے جغرافیائی مفروضوں
کی تردید کی ہے اور ان کے فرضی جزیروں اور پہاڑوں کو محض افسانہ
قرار دیا ہے ۔ البیرونی کا کہنا ہے کہ ان کی جغرافیائی معلومات بے علموں
کے لئے ہیں اور ان کے محقق حقائق سے بے خبر اور پراگندہ خیال ہیں ۔

دریا :

بر صغیر پاک و ہند کے متعلق البیرونی لکھتا ہے کہ اس کے تین
سمتوں میں بلند و بالا پہاڑ ہیں اور جنوب کی طرف سمندر ہے ۔ پہاڑوں
اور سمندر کے درمیان میدان ہے جس میں دریا بہتے ہیں ۔ شمالی ہند
کے پہاڑوں کے متعلق البیرونی کی یہ رائے ہے کہ ان کا سلسلہ ترکستان
تک پھیلا ہوا ہے اور ان سے پگھلنے والی برف اور چشموں کا پانی جو
شمالی جانب گرتا ہے وہ دریاؤں کی صورت میں بہتا ہوا بحیرہ ارال یا
بحیرہ خزر میں جا گرتا ہے اور جو پانی جنوبی سمت گرتا ہے وہ بر صغیر کے
دریاؤں کی صورت میں بڑے سمندر میں جا گرتا ہے ۔ اس کا کہنا ہے کہ
ہندوستان کے دریا یا تو شمالی پہاڑوں سے نکلتے ہیں یا مشرقی
پہاڑوں سے ۔ اس کے خیال میں شمالی اور مشرقی پہاڑوں کا تعلق ایک ہی
سلسلہ کوہ سے ہے ۔

پنجاب کے دریاؤں کے متعلق البیرونی کی یہ معلومات کتنی صحیح
ہیں کہ یہ سب دریا پنج ند کے مقام پر مل جاتے ہیں اسی طرح اس نے
دریائے سندھ کا جو راستہ بتایا ہے وہ بالکل صحیح ہے ۔ دریائے سندھ
کی طغیانی کے بارے میں البیرونی لکھتا ہے کہ سیلاب کے دنوں میں اس
دریا کا پاٹ دس فرسخ ہوجاتا ہے اور پانی کی سطح اس قدر بلند ہوجاتی
ہے کہ درخت اس میں ڈوب جاتے ہیں اور جب سیلاب کا پانی اترتا ہے تو

البیرونی کا نظریہ یہ تھا کہ زمین کبھی مائع کی صورت میں تھی اور رفتہ رفتہ اسکی سطح ٹھوس ہوتی گئی۔ البیرونی نے آتش فشاں پہاڑوں کا ذکر کرتے ہوئے یہ بتایا ہے کہ زمین کے نیچے ابھی تک مائع لاوے کی صورت میں موجود ہے جو بعض پہاڑوں سے نکلتا رہتا ہے۔ ایک دوسرے موقع پر البیرونی رقمطراز ہے کہ پہاڑوں کی چٹانوں اور صحراؤں میں ایسے حمادانی آثار موجود ہیں جن سے اس نظریے کو تقویت ملتی ہے کہ زمین کی ساخت میں بے شمار تبدیلیاں ہو چکی ہیں۔

گردش زمین :

زمین کی گردش کے متعلق البیرونی لکھتا ہے کہ زمین کا ایک فرضی محور ہے جسکے گرد وہ گھومتی ہے پھر البیرونی کا یہ بیان کس قدر حیرت انگیز ہے کہ زمین کا محور عمودی نہیں بلکہ جھکا ہوا ہے (یہ $23\frac{1}{2}$ کا زاویہ بناتا ہے) ۔

سمندر :

البیرونی نے اپنی تحریروں میں خلیج فارس، بحیرہ عرب، بحر اسود، بحیرہ ارال، بحیرہ خزر، خلیج عقبہ، بحر قلزم، بحر ہند اور بحر محیط کا ذکر کیا ہے۔ وہ ان سمندروں کے محل و قوع اور حدود اربعہ سے کما حقہ واقف تھا۔ اگر کسی سمندر میں جزیرہ آتا ہے تو وہ اسکی بھی نشاندہی کرتا ہے۔ ہندوستان اور چین کے درمیان جو سمندر حائل ہے اسکا ذکر کرتے ہوئے وہ لکھتا ہے کہ یہ سمندر شمالی سمت کو مڑا ہوا ہے۔ میری دانست میں اس موڑ سے اسکی مراد جنوبی بحر چین ہے۔

مدوجزر :

البیرونی نے سمندر میں ہونے والے مد و جزر کی بھی تحقیق کی ہے اور وہ اس نتیجے پر پہنچا ہے کہ مد و جزر کا تعلق چاند کی کشش سے ہے مد و جزر کا ذکر کرتے ہوئے البیرونی لکھتا ہے کہ سومنات کے مندر میں

البیرونی اور علم جغرافیہ

پروفیسر محمد اسلم

البیرونی کا شمار ان عظیم سائنسدانوں میں ہوتا ہے جن کے فیض علم سے ایک عالم سیراب ہوا ہے ۔ البیرونی نے فلسفہ ، ہیئت ، رمل ، جغرافیہ ، ارضیات ، علم الابدان اور طب کے موضوع پر بہت کچھ لکھا ہے اور ان تمام مضامین پر اس کی معلومات جمع کرنے کیلئے ایک دفتر درکار ہے۔ اس مختصر سے مقالے میں اس کی جغرافیائی خدمات کا تعارف کرانا مقصود ہے البیرونی کی تصانیف کے مطالعے کے بعد اسکی جغرافیائی معلومات کی داد نہ دینا مشکل ہوگا ۔ اسکی جغرافیائی معلومات اتنی وسیع اور صحیح ہیں کہ اسکے سامنے قرون اولیٰ یا قرون وسطیٰ کا بڑے سے بڑا جغرافیہ داں بھی بونا ٹھیرتا ہے اس نے اپنے تجربات اور مشاہدات سے اپنے پیشرو جغرافیہ دانوں کے باطل نظریات کا جس طریقے سے رد کیا ہے وہ اسی کا حصہ تھا۔

زمین :

البیرونی سے پہلے محمد بن موسیٰ الخوارزمی زمین کو گروی ثابت کرچکا تھا ۔ اس نے یہ نظریہ اس وقت پیش کیا تھا جب یورپ کے فضلا زمین کو چپٹا تصور کرتے تھے اور انہوں نے اس نظریے کو مذہبی عقیدے کا رنگ دے دیا تھا اور اس عقیدے کا منکر کلیسا کی نظر میں قابل گردن زدنی سمجھا جاتا تھا ۔ البیرونی نے محمد بن موسیٰ الخوارزمی کے نظریے پر مزید تحقیق کی اور بتایا کہ زمین کا گروی ہونا بے حد ضروری تھا اگر ایسا نہ ہوتا تو زمین شمالی سمندر کی جانب بڑھ جاتی اور پانی جنوبی سمندر کی طرف بڑھ جاتا ۔ البیرونی نے جہاں زمین کے گروی ہونے کی اور کئی سائنٹفک دلیلیں دی ہیں وہیں یہ بھی لکھا ہے کہ زمین کا گروی ہونا آنکھوں سے دیکھا جاسکتا ہے ۔

PICTORIAL HIGHLIGHTS



H. E Mr. Fazal Elahi Chaudhry, President of Pakistan, inaugurating the Islamabad/Rawalpindi session of the Congress on December 4, 1973

THE NATIONAL COMMITTEE

under the inspiring guidance of Mr. Qudratullah Shahab, Secretary to the Government of Pakistan, Education, in session



A view of the Committee in session (R. to L.) Hakim Mohammed Said addressing the meeting Dr Mahmud Husain in the Chair Mr Qudratullah Shahab Dr Riazul Islam Dr A H Dani and Dr Muhammad Baqir



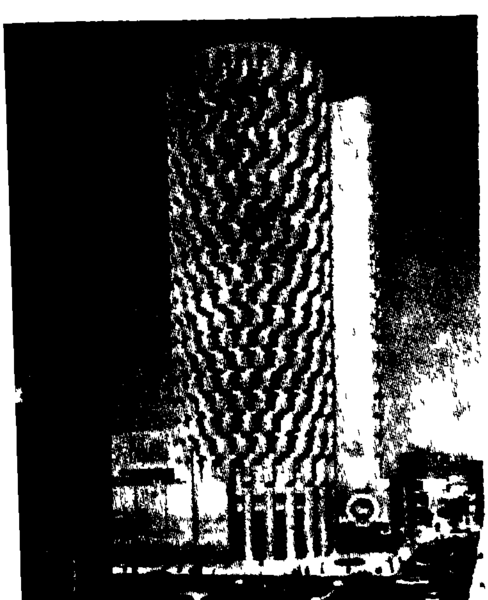
Deep in discussion are (R. to L.) Dr Mohammad Ajmal Hakim Mohammed Said Dr Mahmud Husain and Mr Qudratullah Shahab



[illegible] of the Committee (R. to L.)
Dr Mohammad Ajmal
Dr Israrul Haq
Mr A. K. Brohi
Dr (Miss) Kaniz Yousuf
Prof Ghulam Mustafa Shah
Mr Qudratullah Shahab
Dr Mahmud Husain
Prof Karrar Husain
Dr Mohammad Islam Sheikh
and Hakim Mohammed S[illegible]



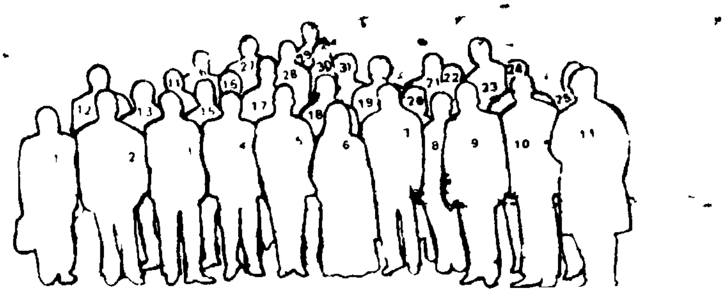
A front view of Habib Bank Plaza, venue of the al-Biruni International Congress with flags of participating countries in the foreground.

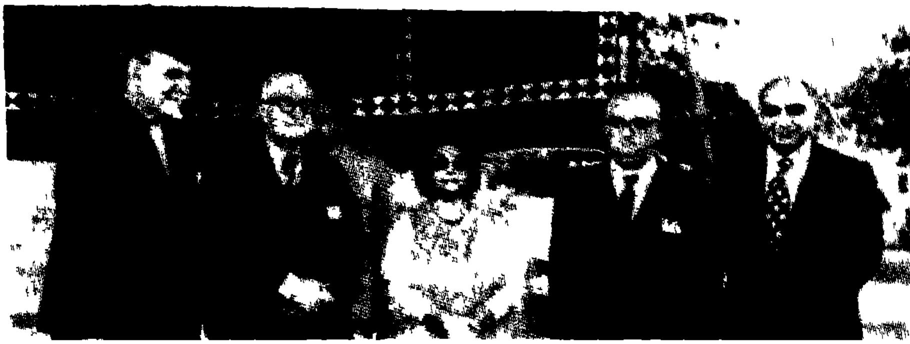


A view of Habib Bank Plaza where the Karachi Sessions of the Congress were held on its 22nd floor.



H. E. Begum Ra'ana Liaquat Ali Khan, Governor of Sind, gave a reception, in the Governor's House, to the delegates attending the Al-Biruni International Congress. Some of the delegates, as follows, are seen with her (1) Prof. Ibrahim Olgun (Turkey), (2) Prof Mahmud Zayid, (Lebanon), (3) Dr. Saleh K. Hamarneh (Jordan), (4) Dr. M. Nadjmabadi (Iran), (5) H. E. Dr. Seyyed Hossein Nasr (Iran), (6) The Governor, (7) Prof. Abdul Kadir Karahan (Turkey) (8) Prof. Ahmed S Saidan (Jordan), (9) Dr. Mohammed Souissi (Tunis), (10) Dr. Sami K. Hamarneh (U. S A), (11) Hakim Mohammed Said (Pakistan), (12) Dr. A. D. H Bivar (U. K.), (13) Prof. Dr Syed Naguib al-Attas (Malaysia), (14) Dr. Hisham Nashabi (Lebanon), (15) Prof. Ismail R. Al-Faruqi (U. S. A.), (16) Prof. Aydin Sayılı (Turkey), (17) Prof Jussi Aro (Finland), (18) Prof. Bertold Spuler (Germany), (19) Prof. J. C. Burgel (Switzerland), (20) Madame Roger Arnaldez (France), (21) Prof. Akbar Danaseresht (Iran), (22) Prof. Roger Arnaldez (France), (23) Prof. [illegible] (U. S. S. R.), (24) Dr. Anton Heinen (U. S. A.), (25) Dr. Mahmud Husain (Pakistan), (26) Prof. Lawrence Ziring (USA), (27) Prof Dr. Georges Anawati (Egypt), (28) Prof. W. Montgomery Watt (U K), (29) Prof. Mehdi Mohagegh (Iran); (30) Hakim Mohammed Yasin (Pakistan), (31) Prof. Abdulgani Mirzoev (U. S. S. R.).

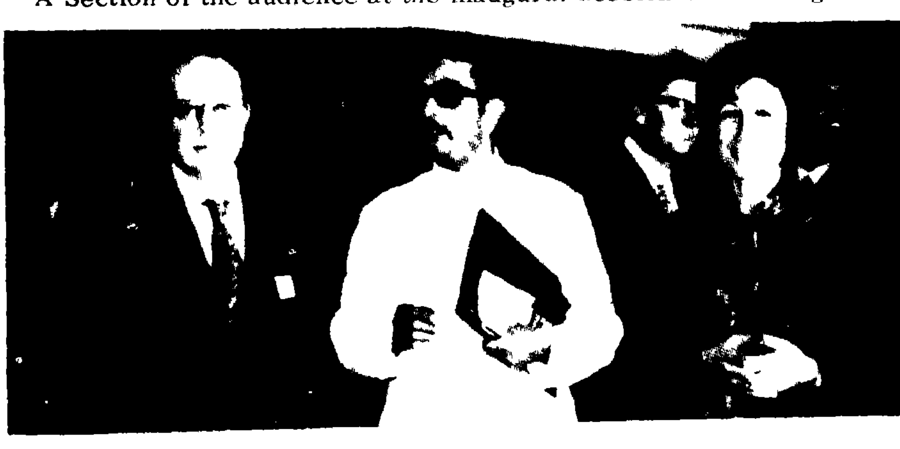




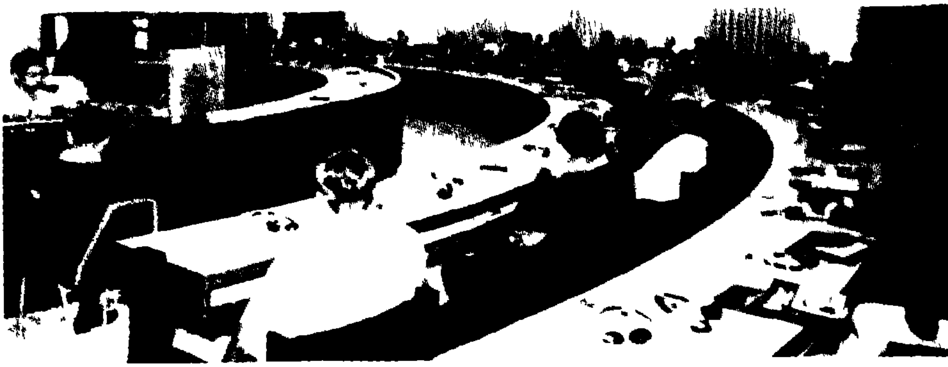
H E. Begum Liaquat Ali Khan with (L to R) Al-Sayed Kadir al-Gaylani, Dr M. Nadjmabadi, Professor Akbar Danaceresht and Dr M Moayeri



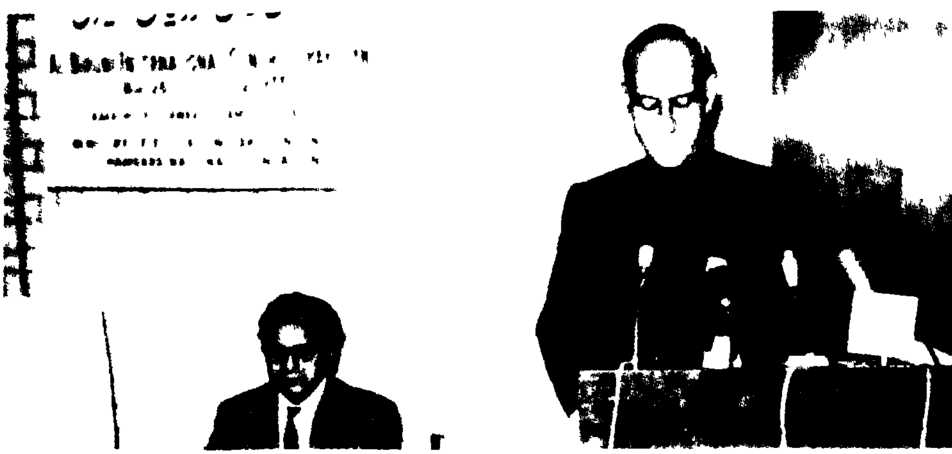
A Section of the audience at the inaugural Session of the Congress



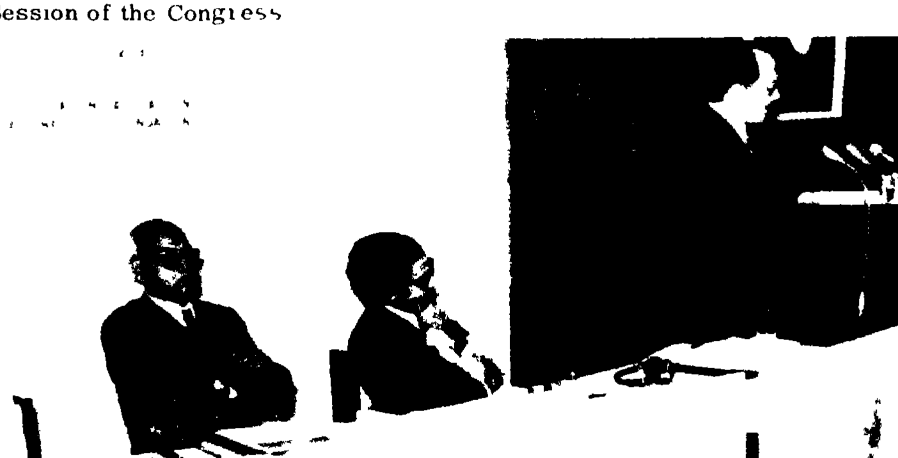
L to R. Dr S al-Munajjid, Hakim Mohammed Said and Mrs Donia al-Munajjid. In the background are Dr J C Burgel and Mr A Ghafur



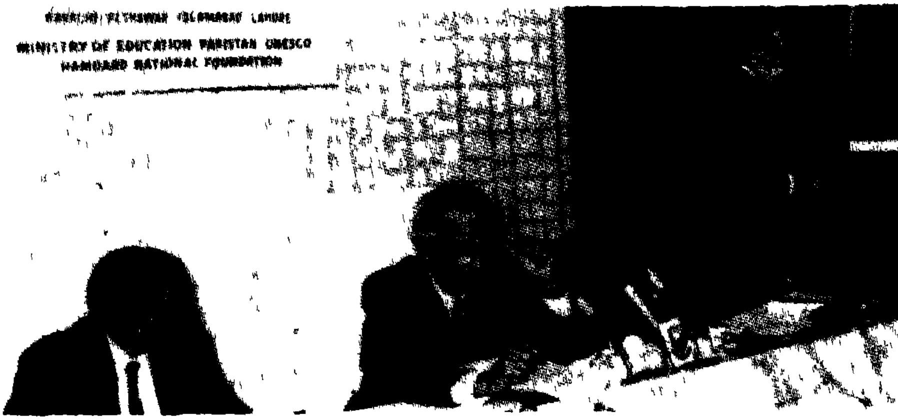
At one of the Karachi Sessions of the Congress



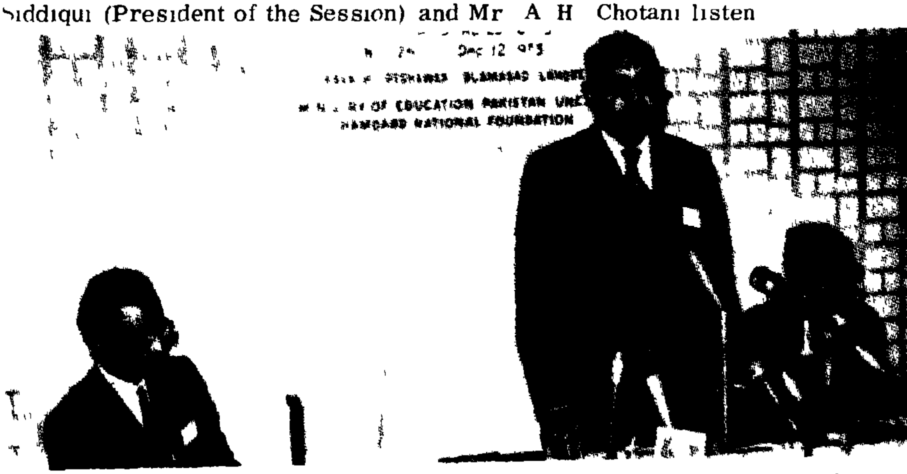
Dr Mahmud Husain, Vice-Chancellor University of Karachi, addressing a Session of the Congress



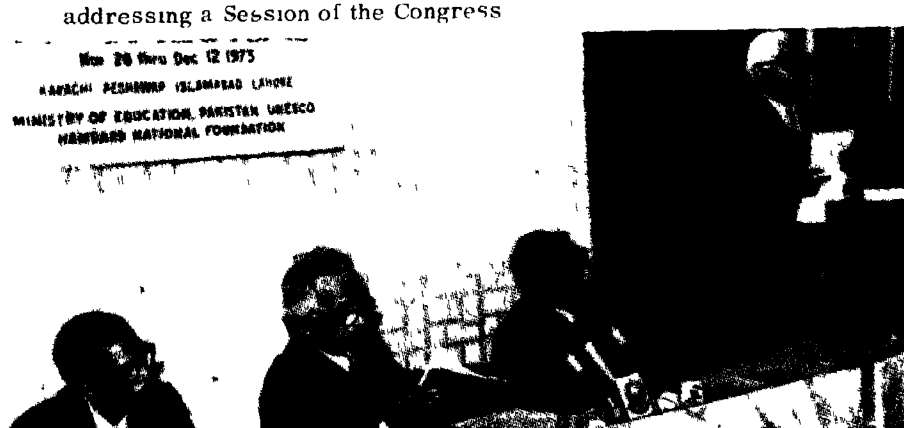
H E Dr Seyyed Hossein Nasr reads his paper Mr A K Brohi, President of the Session is on the left and Dr Manzoor Ahmad is in the centre



Dr G Anawati reads his paper (L to R) Dr. Fazle Karim, Dr Salimuzzaman Siddiqui (President of the Session) and Mr A H Chotani listen



Dr I H Qureshi, former Vice-Chancellor, University of Karachi, addressing a Session of the Congress



Dr S Sibte Nabi Naqvi reads his paper Listening are Dr Fazle Karim, Dr Salimuzzaman Siddiqui and Mr A H Chotani



H E Mr Mohammed Aslam Khan Khattak, Governor, N W F P inaugurates
he Congress at Peshawar
Dr A D H. Bivar, School of Oriental & African Studies, University of London
presents his paper



L to R. Dr A D. H Bivar, Professor Abdul Ali Khan, Vice-Chancellor,
University of Peshawar, H E Mr. Mohammad Aslam Khan Khattak and
Dr Munawwar Khan.



At the dinner hosted by H E Mr Mohammad Aslam Khan Khattak in honour of the delegates L to R. Dr A D H Bivar, Professor Mehdi Mohagegh, Professor Ismail R. al-Faruqi (shaking hands with the Governor) Professor Jussi Aro and Dr S. Marghoob Ali



The Governor seen talking to some of the delegates at the Governor's House



The delegates in a jolly mood at Torkham, near the Khyber Pass



Dr S A Rahman Chief Justice of Pakistan, who presided over Sham-i-Hamdard, with Professor Bertold Spuler



The President of Pakistan Mr. Fazal Elahi Chaudhry arrives for the inauguration of the Congress at Islamabad. He is flanked by Dr Kaniz Yousuf Vice-Chancellor University of Islamabad and Hakim Mohammed Said



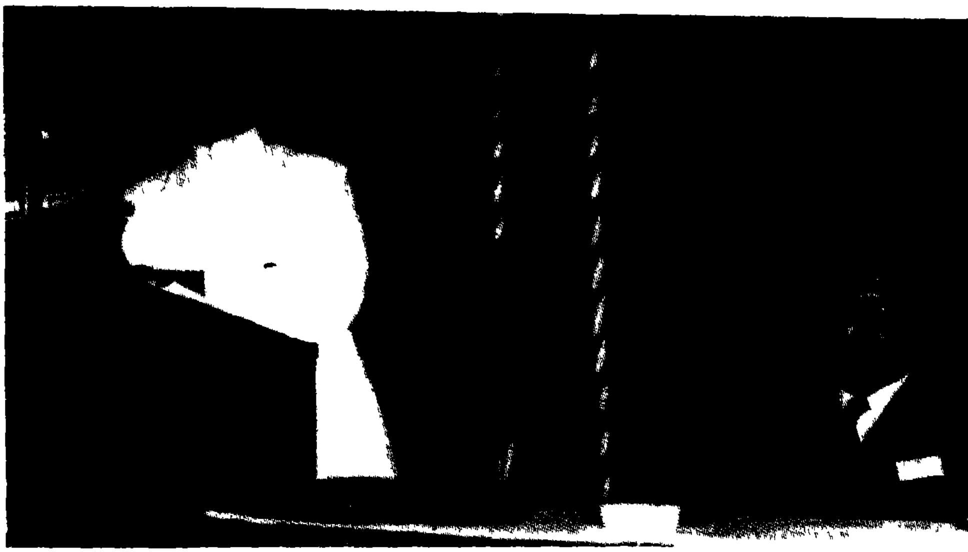
(R. to L.) Dr. A. H. Dani, H. E. Mr. Aly Abou El Fadl Khashaba, Professor Shaikh Abdul Rashid



Hakim Mohammed Said converses with Mr Masarrat Husain Zuberi



Dr Z A Hashmi Chairman Pakistan Science Foundation delivering the presidential address at Sham-i-Hamdard, Rawalpindi Professor W Montgomery Watt, Guest Speaker is at the right



Hakim Mohammed Said introduces Professor Bertold Spuler, Guest Speaker at Sham-i-Hamdard, Lahore



At a Lahore Session Professor Hameed Ahmad Khan, former Vice-Chancellor, Punjab University presides Professor Mohammad Usman reads his paper



AL-BIRUNI'S

COMMEMORATIVE POSTAGE STAMPS

26 November, 1973

Pakistan Post Office

Salient Features

1. Size of Stamps.. ....32.5X44.5 m.m.
2. Size of print.. .. ..29.5X41.5 m.m.
3. Perforation gauge............ . . .13 X 13 (C)
4. Number of stamps in each sheet 50
5. Colour.......................Yellow/Red/Blue/Black.
6. Process of printing.......... ....Litho Offset.
7. Denomination.... .... 20 Paisa and Re. 1.25
8. Quantity printed...... . ... .5,00,000 each.
9. Printers The Pakistan Security Printing Corporation Ltd., Karachi.
10. <u>DESIGN</u> Format of the stamps is horizontal. The portrait of al-Biruni appears on the left side against the picturesque background of Nandana Hill——the site of the observatory of al-Biruni——in District Jhelum of the Punjab.